ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 14, No. 4. WEEKLY.

NEW YORK, SATURDAY, MARCH 23, 1889.

$3 per annum. Single Copies, 10 Cents.

Copyright, 1889, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

"LIGHT AND COLOR" AT THE ELECTRIC CLUB.

PROF. ROBT. SPICE HIGHLY ENTERTAINS AND INTERESTS A LARGE AUDIENCE.

A very entertaining and deeply interesting lecture, artistically illustrated with apparatus, was delivered before the Electric Club, Thursday evening, March 14th, to a representative and enthusiastic audience that filled the large double parlors on the first floor. President E. T. Gilliland presiding.

The speaker was Professor Robert Spice, a member of the Club and professor of chemistry at Cooper Institute, New York, whose subject was "Light and Color." Professor Spice was particularly happy, his experiments proving everything to the perfect satisfaction of his audience as he went along. A small arc light was used for the purpose of illustrating on the screen, and was run from the electric light plant in the Club house regulated by rheostat. All the apparatus was placed in the front end of the parlor, and as experiment after experiment was given, and the statements of the Professor clearly proven, the enthusiastic recognition of the audience became very flattering. Professor Spicé was applauded again and again, and at the conclusion of his lecture was warmly congratulated and a vote of thanks unanimously tendered to him.

We hope to be able to publish the address in a subsequent issue. It was delivered without notes, but was recorded by the official stenographer of the Electric Club, who, however, had to work under the difficulty of taking his notes in the dark the greater portion of the time, as the electric lights were turned off so as to make use of the magic lantern.

Among the gentlemen in the audience were: Capt. Henry Erben, U. S. N., Lieut. H. Schuyler Ross, U. S. N., Lieut. F. W. Toppan, U. S. N., H. C. Adams, P. C. Ackerman, W. L. Candee, Geo. B. Coggeshall, J. C. Chamberlain, E. A. Colby, W. M. Clark, J. J. Carty, Chas. Dutton, I. H. Davis, Stephen D. Field, T. L. Fowler, Wilfred H. Fleming, E. T. Gilliland, M. W. Goodyear, A. V. Garratt, James W. Godfrey, W. B. Dowse, R. E. Gallagher, E. F. Gennert, with Messrs. Whitney and Cunningham, F. W. Harrington, James Kempster, George Parsons Lathrop, O. E. Madden, W. J. Morrison, E. R. Knowles, E. F. Peck, W. D. Packard, A. F. Stanley, C. E. Stump, John C. Tomlinson, S. S. Wheeler, Geo. C. Wilde, Geo. Worthington; Dr. Amory and Mr. C. J. H. Woodbury, of Boston; Mr. Eugene F. Phillips, of Providence; Mr. William Powe, of Ansonia, Conn.; Dr. Leonard Waldo, of Lockport, N. Y.

At the conclusion of the lecture it was announced that a lunch and other refreshments would be served in the dining room above, and the audience to a man availed themselves of the excellent entertainment thus provided. It was discovered later that Mr. Gilliland personally was the host, this being a special meeting, and his health was drank most heartily.

The Club is to hold another meeting Thursday evening of this week (March 21st) for the purpose of nominating a ticket for the ensuing year. Much interest is being taken in the Club election, and it is likely that a good deal of friendly rivalry will crop out before the polls close on the evening of the election, which occurs April the 18th. There should be a good attendance at the nominating meeting, as there undoubtedly will be at the annual meeting one month later.

Armington & Sims Engine with Brush Dynamos.

The illustration on this page is taken from a photograph of the electric steam plant on board the U. S. cruiser "Boston." A pair of the widely known Armington & Sims engines are shown, connected direct to a Brush dynamo. On board these ocean vessels, where every inch of space is so desirable, such arrangement of the lighting plant is most desirable, and the Armington & Sims people are said to have achieved a great success in this line of work.

The Graphophone Made the Type-writer Blush.

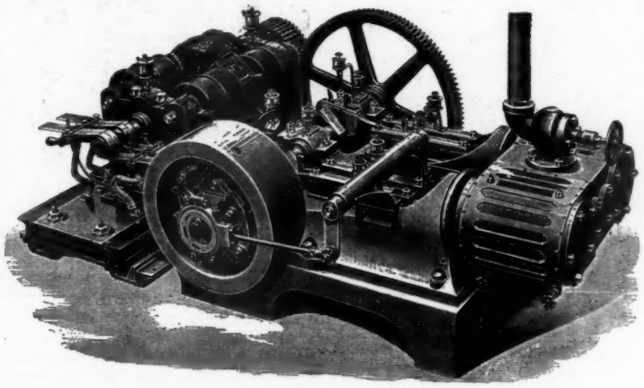
Private Secretary Pearson, of Governor Beaver's office, Harrisburgh, Pa., had a curious and somewhat startling experience with the graphophone. He began to turn the crank and supposed that he was about to cause the machine to give out to the young lady type-writer a message which the Governor had talked into it the evening previous. The young lady was all attention, and the Private Secretary began solemnly to turn the crank, which works by a treadle. To his horror and the immense embarrassment of the young lady the following amorous jumble was given out with decided emphasis: "Now, don't, George. * * * There; somebody will come. Of course, I love you. There, somebody really is coming, and you have mussed my hair all up. * * * Please, love, I am so afraid that some one will come in, and, besides, I can't work this crank if you insist upon kissing me all the time." * * * The stars represent sounds too familiar to be mistaken. They were the smacking of lips and other sounds which accompany the interchange of caresses between lovers.

It was some little while before the matter could be satisfactorily explained either by the young lady or by Mr. Pearson, who at first were disposed to imagine that somebody had been playing a practical joke upon them. The matter was finally straightened out, however, when the Executive Clerk came around, and, upon hearing of the incident, laughed heartily. He had, on the evening before, been showing a bride and groom about the Executive Department, and, being called away for a few minutes, had left them in the Private Secretary's room to amuse themselves with the graphophone while he attended to the business which had called him away.

A New Electric Fixture Company.

The Bergmann Electric and Gas Fixture Company has been organized and has secured the large building fronting on Thirty-fourth street, numbered 527, 529 and 531 West. The building has 75 feet front, is seven stories high, and 50 feet deep. An extension is also being added running back 85 feet more.

The well known electric and gas fixtures manufacturers, Messrs. S. Bergmann and P. H. Klein, Jr., are at the head of the company, the officers being as follows: S. Bergmann, president; E. F. Caldwell, vice-president, and P. H. Klein, Jr., secretary and treasurer.



Brush Dynamo and Armington & Sims Engine.

The building is being fitted up in first class manner, and the company expect within the next 30 days to commence the delivery of goods. Messrs. Bergmann and Klein were formerly with Bergmann & Company, manufacturers of electric light fixtures for the Edison system, but have withdrawn from that company, and will now enter into the general business of manufacturing electric light and gas fixtures for which their long experience in the past and business sagacity most thoroughly fit them.

Lighting of Lockport, N. Y.

The Common Council of the city of Lockport, N. Y., on March 11th unanimously adopted the report of a committee recommending a further two years' contract for lighting the city with the Lockport Gas Light Company, on conditions as follows:

1. That the company shall furnish arc electric lights of 2,000 candle-power each for $80 per year; incandescent electric lights of 20 candle-power each for $14 per year; gas lights for $15 per year.

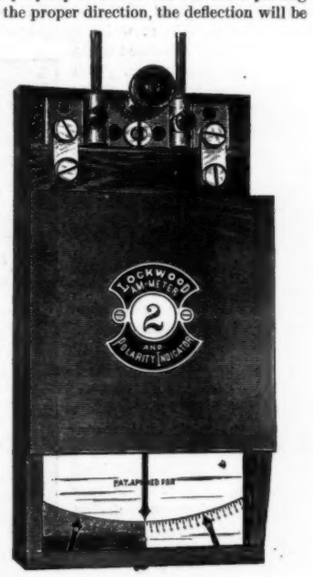
2. The company to make all repairs except to gas lamps.

3. All lights to be lighted all night every night *except when the moon is full.*

The mayor may veto this action, but it is probable the Council will pass it over a veto.

Lockwood Ammeter and Polarity Indicator.

The illustration herewith gives a perfect representation of the Lockwood instrument. The principle of action is, of course, magnetic, and the internal arrangement is such that—always assuming that the connections are properly made—if the current is passing in the proper direction, the deflection will be



to the light (right of the cut) side of the scale. On the other hand, if the connections are reversed, the needle will deflect to the dark side of the scale. This advantage will be particularly appreciated by those who have suffered from unwittingly heading the current in the wrong direction. With this instrument the necessity of a pilot lamp in the station is done away with, and permits, therefore, of one additional lamp on the circuit for use or rental. A cut-out is arranged so that the instrument can be detached at any time readily, or several of these, in a central station, may be connected upon one circuit for adjustment by comparison. The adjustment is perfectly simple and easy, and consists in the movement of balancing weights upon the needle until this is brought to act uniformly with the standard. Once a standard is thus obtained, the remainder of the instruments can be adjusted to correspond. The use of the instrument as an ammeter and indicator of current steadiness is rendered perfectly easy, as the contrast between the broad dark needles and the white scales makes the condition of affairs visible from any distance away in an ordinary dynamo room. The face plate contains a space in which to place the number of the circuit. The Central Electric Company, 42 La Salle street, Chicago, is the sole agent for the above instrument.

Electric Light Bids for New York City.

The Gas Commission has ordered bids to be advertised for to light the streets for the year beginning May 1st next. Mayor Grant states that the appropriation is no larger than last year's, and that if the electric light companies undertake to raise their prices in districts where there is no competition, the Commission will return to the use of gas. New York lighted with gas would be a sight for the gods, and would give a lustre to the Grant administration that would not soon be forgotten!

The Edison Lamp Patents in Canada.

Early in the year 1888, the Edison Company brought suit in the Superior Court at Montreal, against the Royal Electric Co., for infringement of the Edison lamp filament patent No. 10,654.

The Royal Co. entered a plea for stay of proceedings until a decision could be had upon a petition made by the Royal Co. to the Hon. R. Pope, Deputy Commissioner of patents, for the annulling of the said Edison lamp patent, on the ground of non-manufacture within two years from the date of the patent as provided by law, and that a three months' extension granted them in which to commence manufacture was obtained by false and wilful misrepresentations, that the patentee and assigns had imported into Canada after the twelve months allowed by law, and had refused to sell their lamps at a reasonable price and therefore pray that the patent may be declared void. The Royal Co. were supported by the Consolidated & Sawyer-Man Co.'s, the Westinghouse and United States, and the Thomson-Houston Co., of whom the Royal Co. are a licensee.

The petitioners claim that the Edison Co., although commencing manufacture in Canada within the limit of the law, did then import the parts from which to make the lamp and have continued to do so until this present time. That the glass from which the globes are formed, the carbonized filament and accessory parts were made into form in the United States and merely assembled here. That the Edison Company refused to sell their lamps to any but purchasers and users of their dynamo machinery. The Edison Company admit the importation of the glass bulbs, glass tubing, platinum and copper wires and carbon filament, and that the importation still continues, but advance the claim that these parts are all raw material; that the carbon filament as imported is only partly manufactured in the States, and that the carbonization is completed in Canada. That if the Edison Company had been compelled to make their carbon filaments, draw the platinum wire and blow the glass globes in Canada, it would have ruined their business. The Edison Company also claim there is no absolute proof that they have refused to sell their lamps except to users of their apparatus, and that the law cannot be reasonably construed to compel them to sell to opposition companies who would run the lamps on arc and other plants not suited to their lamp, and thus destroy the reputation of the Edision lamp.

There is, we believe, considerable misapprehension in the "States" as to the standing and value of a Canadian patent, and to place before our readers the true position in such matters, we will give below the leading features of the Hon. Mr. Pope's decision in the Bell Telephone case, where an exactly similar defence was made, violations of the patent act occurring in the same manner as has been the case with the Edison Company in this instance. We will afterwards quote the salient features of Commissioner's decision in the Edison case.

The first decision of this kind was that of Barter vs. Smith, tried before the Hon. Mr. Tache, then Commissioner of Patents, in November, 1876 This judgment has been made the basis of both the Bell Telephone decision of 1885 and of the present Edison case, because it constitutes the declaratory law of the country on points raised by the application of the 28th section of the patents act of 1872, being in matters of doctrine and of legal interpretation unquestionably correct, and endorsed by the highest judicial authorities in the Dominion.

The 28th section of the patent laws of 1872, now the 37th section of the patents act of the Dominion of Canada, provides that the patented article shall not be imported later than one year from the date of such patent, and in case such importation is had later than the specified time, the patent becomes null and void.

The same act provides that the patented article shall be continuously manufactured on and after two years from the issue of such patent. In case of neglect to comply with section 37 of the patents act, or on refusal to sell the article to any one desiring to purchase it, at a resonable price, the patent may, on appeal to the Commissioner of Agriculture, be declared null and void.

The decision in the present Edison case was based on this act and on the decision in the Bell Telephone case. We now quote such portions of the Hon. Mr. Pope's decision in the Bell case as have a bearing on the present one. It is as follows:

"This patent, like all patents granted, is therefore under the obligations exacted from all parties by section 37 of the patents act, and subject to the adjudication of this tribunal should disputes arise as to whether it has or has not become null and void under the provisions of this section. * * * The first allegations of the petitioners in this case are that illegal importations have been made of the patented article after the twelve months from the date of the patent. * * * During the first year of the existence of the patent, then the patentee or his legal representatives imported or caused to be imported, instruments ready for use as they had a right to do; a few days after the expiration of the twelve months they also imported or caused to be imported, other complete instruments, which later importations, being inconsiderable and apparently done in good faith and not with any intention to evade the laws, is declared not to have forfeited the patent. There remains now to examine what was done after that time. * * *

"It will expedite matters to consider together the two questions raised in the dispute of illegal importation and non-manufacture; for in the measure that illegal importation goes on, in that measure the industry and labor of the country are deprived of the benefits of manufacture. Therefore we have to examine what in these instruments is raw material which does not fall under the application of the 37th section, and what is industry and labor. * * *

"The raw materials of this instrument comprise steel in bars, soft iron, wood and vulcanized rubber, to which must be added as common articles of commerce silk covered wire and japanned plates, screws, nuts and maybe iron posts. * * * The question comes then: Has the patentee or his legal representatives imported or caused to be imported after twelve months of the existence of the patents the new article of manufacture patented? There cannot be a shadow of a doubt they have imported and caused to be imported the articles manufactured in parts, to be simply put together. * * * It is in fact virtually admitted by them, when pleading, that putting together, or assembling the parts ready made, is construction and manufacture in the law. It is equally evident that during the same period * * * they have failed to manufacture to the extent they have imported. * * *

"To evade the law and to give color to the importation the instrument was sent in, in pieces to be put together in Canada. * * * All this is proved in the clearest manner, by customs paper, by accounts furnished, and by declarations. * * * So far as the law requires a prompt introduction in Canada of a patented invention, the patentees have observed the law, but the protective policy of the patent act they have in intention and in effect evaded. In support of the pleading that the importation of an instrument in parts is no importation, a recent ruling of the English courts was cited, in which case it was decided that the importation of the materials of a composition of matter was no infringement of the patent, * * * but the conclusion which is correct in the abstract fails in the merits as applied to the present case. The materials of a composition are iron materials unworked, * * * but the moment these are worked into shape and form they cease to be raw materials and become manufactured articles." On the evidence above cited the patents were declared null and void.

The Edison Company raised the question of the jurisdiction of a Minister of Agriculture, but being upheld by numerous precedents and law as expressed in the 37th section of the patent act, the Hon. Mr. Pope claims entire jurisdiction.

In considering the case on its merits the Commissioner says:

The first consideration which presents itself is, to ascertain the nature of the invention claimed by the patent, the claims of which are:

First. "An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance made as described, and secured to metallic wires as set forth."

Second. "The combination of carbon filaments within a receiver made entirely of glass through which the leading wires pass, and from which receiver the air is exhausted for the purpose set forth."

Third. "A coiled carbon filament or strip arranged in such a manner that only a portion of the surface of such carbon conductor shall radiate light as set forth."

Fourth. "The method herein described of securing the platina contact wires to the carbon filament and carbonizing of the whole in a closed chamber, substantially as set forth."

It is manifestly clear that the essential feature or element of the invention, as particularly described in the first and second claims is—*a carbon filament of high resistance*, this is the novelty which the inventor has contributed to the art of incandescent lighting, and it cannot be disputed by anyone having the slightest acquaintance with patent law, that the carbon filament as imported by the patentee and his representatives, the respondents, and which they still continue to import, is claimed in and covered by the patent; or that anyone who should use it, without the permission or consent of the respondents, would render himself liable to them in an action for infringement of the patent.

The process of further carbonizing the filament after it is introduced into the bulb by passing an electric current through it while a high vacuum is maintained, as described by some of the witnesses for the respondents, as well as by Mr. Edison himself, is not anywhere described or claimed in the patent and forms no part of it; on the contrary, it is the subject of another patent, obtained subsequently, by the same inventor, Mr. Edison, on the 5th of July, 1881, under the number 13,037, the fourth and fifth claims of which are as follows:

View of the Electric Road at Syracuse, N. Y.

Fourth. "The method of treating carbon conductors for electric lamps, consisting in enclosing the conductor in a glass case or globe, exhausting the air therefrom, heating the conductor by an electric current and then hermetically sealing the glass case or globe."

Fifth. "The method of treating carbon conductors for electric lamps, consisting in closing the conductor in a glass globe, or exhausting the air therefrom, heating the conductor by an electric current to a higher degree than that at which it is intended to ordinarily raise the conductor in use, and then hermetically sealing the glass case or globe."

Here, then, the process is fully and explicitly described and claimed, and the use or employment of it cannot be invoked or relied on by the respondents, to sustain the patent now in controversy.

The next feature of importance, after the method of securing the platina contact wires to the carbon filament, as set forth in the *first* claim of the patent in contestation, is the glass globe or bulb referred to in the *second* claim, and it is abundantly proved, and admitted by the respondents, that they have always, and still continue to import these, and have never manufactured them in Canada.

Some of the witnesses for the respondents state, that the carbon filaments and the glass bulbs are exceedingly difficult to manufacture, requiring great skill and judgment, and that they cannot be made in Canada, and that there is only one factory in the United States where they can be made to the satisfaction of the respondents; but this seems irreconcilable with the statement of these same witnesses in calling these articles raw material. Mr. Edison himself, in his affidavit, referring to the glass bulbs says: "They are strictly of the character of raw material," and in view of the fact also that the records of the Patent Office show, that on the 23d of November, 1882, Mr. Edison obtained a patent for the process of manufacturing glass bulbs for incandescent lamps from pot glass. The allegation of inability to manufacture in Canada is no plea in defence of a Canadian patent, and it would be a singular misconception of the spirit of the

law if a patentee, probably holding a patent for his invention in the United States or other foreign country, should suppose he could hold to his Canadian patent, declare his inability to manufacture it in Canada, ignore the fact he was thereby preventing any one else from engaging in the industry, and defeating the very object and intention of the Patent Act, enacted to encourage and protect home labor and manufacture.

The bamboo cane was, and continues to be, imported from Japan into the United States, by the respondents, in its natural state, and was there, by a series of manipulations or processes, reduced to a filament of required size and proportion and was then further subjected to the very difficult and delicate process of carbonization, and in this state was imported into Canada expressly for use in the lamps.

The platinum, another component part of the invention, was, and still is, imported into the United States from Russia, by the respondents, and was there melted and alloyed with iridium, drawn into wire, and otherwise specially prepared, and then imported into Canada for use in the lamps.

I find that every essential feature, element and component part of the invention was, and still continues to be, imported into Canada by the respondents, in a manufactured state, for the especial purpose of assembling or putting them together, so as to make an incandescent electric lamp, such as that described and claimed in the patent held by them and now in dispute.

I therefore hold, that the patentee and his representatives have imported into Canada, since the 17th day of November, 1880, and till continue to import the various elements and parts comprising the invention claimed in the patent No. 10,654 in a manufactured state; and that they have not at any time since the date thereof manufactured the invention in Canada.

I accordingly decide that the patent granted to Thomas Alva Edison on the 17th of November, 1879, under the number 10,654, for the Edison electric lamp, has become null and void under the provisions of the 37th section of the Patent Act.

Electric Railway in Syracuse, N. Y.

The Thomson-Houston Electric Railway Company completed the equipment of the Third Ward Street Railway, in Syracuse, on November 29, 1888. The line comprises three miles of single track, with the necessary turnouts, and nine curves, three of which are reverse. Overhead construction has been used throughout its entire length.

The road runs through Genesee street, the principal residence street of Syracuse, and terminates in the business center of the city. The company are operating eight cars, two of which are equipped with two 15 horse power Thomson-Houston motors, and six with two 10 horse power each. Five of these are in daily use, and each day cover a distance of 80 miles per car. When the entire length of the line is operated each car will make a distance of 89 miles a day.

The station and car house are situated about a mile and a quarter from the center of the city, and directly on the line of the road. The power plant consists of two 80 horse power Thomson-Houston generators, and two 80 horse power Armington & Sims engines and boilers, having a total capacity of 250 horse power.

During a severe snow and wind storm, which visited Syracuse some time ago, when the horse cars were operated with great difficulty, and at a very slow rate of speed, the electric cars maintained their regular speed and did not lose a trip; thus showing that electricity, as a means of street car propulsion, is far ahead of animal power, especially under such conitions.

Electric Welding.

We illustrate herewith apparatus specially designed for electric welding processes by Prof. Elihu Thomson, aided by Mr. Lemp, electrician of the Thomson Electric Welding Company. In the earlier days of experiment in this line, suitably modified electric lighting apparatus would give satisfactory results; but with its wonderful growth and advance, specially constructed apparatus was a necessity which was successfully met by Prof. Thomson and his able assistants, so that now welding by electricity is performed quickly, economically and with absolute certainty even by unskilled hands.

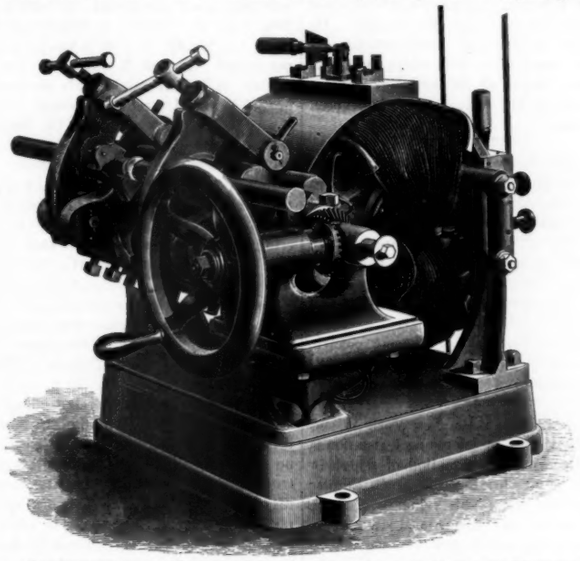


FIG. 1.—TRANSFORMER OR WELDING COIL OF THE THOMSON ELECTRIC WELDING CO.

Fig. 1 shows the transformer or welding coil. In it the secondary circuit is a copper tube. Through a slit made in this are slipped the coils of the primary circuit previously wound on a form; the iron disks have also a slot, by means of which they are slipped around the tube of the secondary and through the interior of the primary coils. The only active portion of the secondary or welding circuit is this copper tube. The conductors from this to the clamps are very short and of large sections, thereby obviating any heating due to resistance. One jaw is fixed, the other movable, has sliding contact on the rod supporting the clamp or on the bedplate of the clamp itself. In some cases flexible conductors have been used attached to clamps placed in guide beds. The general compactness may be seen at a glance, and a greater out-put of current is undoubtedly obtained than ever before, and at a very high efficiency. Its durability under the most trying conditions cannot be questioned, for even the earliest machines are in good condition to-day, uninjured by heavy hammering of the weld. This, however, is unnecessary, as an unhammered weld is fully as strong as the rest of the metal. Where a large amount of work in any particular metal is done, it is found advantageous upon work requiring longer secondary than copper to build special types, a large number of which are manufactured by the company.

The dynamo, Fig. 2, is compound wound under patents the property of the company, is believed to be as, or more, efficient than any other alternate current dynamo ever made, and is the result of experiment, conducted by Prof. Thomson and Mr. Lemp. Special attention was given to the rapid "building" of the fields, a feature not necessary in dynamos for electric lighting. The machine work, at once durable, exact, and beautiful in design and finish, is done entirely by skilled mechanics, of whom over 100 are at present employed in the factory. Besides the dynamo illustrated, other types are made, in some cases of bipolar construction. The range of work that can be done by these machines includes the finest watch and steam engine construction. The machine is self contained, and self exciting, the commutator for which is outside of the bearings.

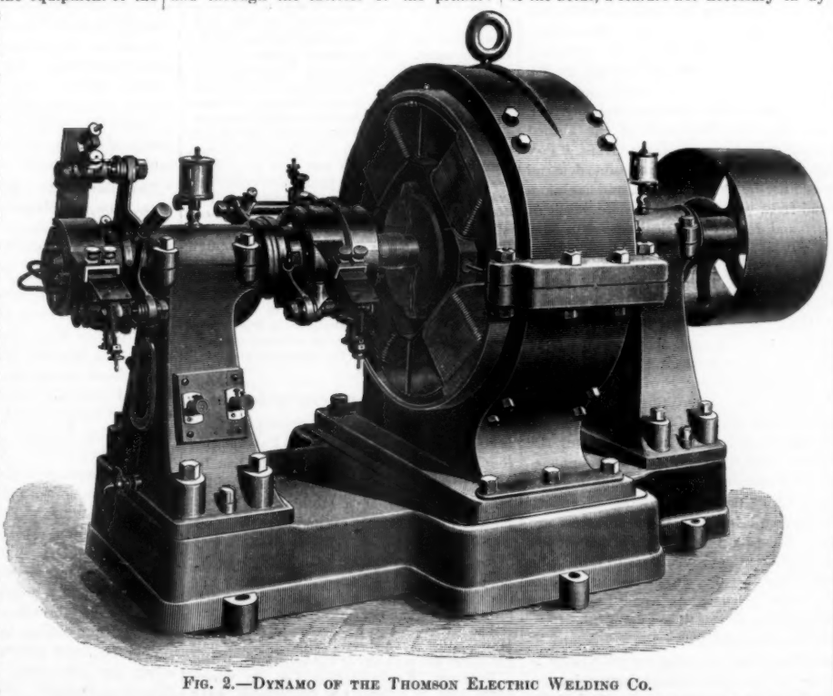


FIG. 2.—DYNAMO OF THE THOMSON ELECTRIC WELDING CO.

Toronto, O.—The Toronto Electric Light and Power Company, Toronto; capital stock, $15,000.

Hagerstown, Md.—The Hagerstown Electric Co. has been incorporated by Chas. E. S. McKee, Thomas B. Cushwa, Jacob Rosner and others.

Portland, Me.—The Curtis Electric Light and Power Company; capital stock, $800,000; A. J. Adams, of Boston, is president, and Walter Mott, of Boston, treasurer.

Tacoma, W. T.—The Pacific Construction Company, to build railways, elevators, steamship, telegraph and telephone lines, and own the same, with a capital of $25,000; trustees, George Browne, Percy Dickenson and Charles King.

Maywood, Ill.—The Maywood and Proviso Electric Light and Power Company, at Maywood, Cook county; capital stock, $20,000; to furnish electric light, etc.; incorporators, Joseph Jennings, Charles W. Kimball, Harrison P. Nichols and others.

Chicago, Ill.—The Swain-Goodsell Metallic Packing Company, at Chicago; capital stock, $150,000; to manufacture and deal in metallic packings and other engineers' supplies; incorporators, Byron W. Goodsell, Fred. F. Swain, and William S. Bates.

Chicago, Ill.—Leonard & Izard Company, Chicago; capital, $300,000; to deal in engines, electrical appliances and supplies of all kinds; to build railways, furnish experts in electrical engineering work; incorporators, H. Ward Leonard, E. M. Izard, H. K. Tenney.

Evanston, Ill.—The Evanston Electric Light and Power Company, at Evanston; capital stock, $30,000; to manufacture and deal in electrical apparatus and all kinds of electric and other light, heat and power; incorporators, John Stuart Philip, John D. Adams and James L. Johnston.

Portland, Me.—The Gethins Electrical Manufacturing Company; capital stock, $200,000; par value shares, $5. President, C. A. Erland, Newton, Mass.; treasurer, J. M. Hall, Cambridge, Mass. The business to be prosecuted is manufacturing and dealing in electrical instruments, machinery, etc.

Nashville, Tenn.—George J. Stocks, George Corbion, Jr., Wm. Dreesbach, F. W. Dedlow and W. Durrell Shuster, filed in the county register's office a charter of the Globe Pneumatic Railway Company, for the purpose of operating machines and motors for furnishing motive power by the pneumatic process or by electricity.

Richmond, Va.—The Electric Liquid Controller Company, for the manufacture of electrical and mechanical apparatus, with T. N. Motley, of New York, president; Anthony Rosenfield, of New York, vice-president; W. H. Brown, of New York, treasurer. The capital stock is to be not less than $50,000 nor more than $500,000.

Harrisburg, Pa.—Charters have been issued to the Quaker City Fuel Gas Company of Philadelphia; capital, $10,000. The Stroudsburg Electric Light and Power Company, capital, $15,000. The Citizens' Electric Light, Heating and Power Company, of Slatington; capital, $20,000. The Equitable Heat and Light Company, of Waynesburg; capital, $2,500.

Newark, N. J.—The Easton Electric Light Company of the United States. The incorporators are: Paul T. Schlight, of Glen Ridge; Henry D. Lyman, S. Gregor Doran and Charles S. Beardsley, all of New York. The capital is $1,000,000, and the object of the company is the manufacture and sale of machinery for making electric lighting apparatus. The principal place of business is Newark, and the company is also to do business in Jersey, New York and Brooklyn.

ELECTRICAL REVIEW

Published at 13 Park Row
P. O. BOX 3329.

GEO. WORTHINGTON, - Editor.
CHARLES W. PRICE, - Associate Editor.
T. J. McTIGHE, Electrician and Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW." NEW YORK.
TELEPHONE CALL, 546 JOHN.

Timothy W. Sprague, Room 58, No. 178 Devonshire Street, is our representative at Boston, Mass.
Mr. C. C. Haskins, City Hall, Chicago, Ill., represents the REVIEW in the West.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries $4.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

NEW YORK, MAR. 23, 1889.

CONTENTS.

	PAGE.
"Light and Color" at the Electric Club	1
Armington & Sims Engine with Brush Dynamo.	1
The Graphophone Made the Typewriter Blush.	1
A New Electric Fixture Company.	1
Lighting of Lockport, N. Y.	1
Lockwood Ammeter and Polarity Indicator	1
Electric Light Bids for New York City	1
The Edison Lamp Patents in Canada	2
Electric Railway in Syracuse, N. Y	3
Electric Welding	3
New Corporations	3
The Copper Question	4
New Books	4
The News:	
Our Boston Letter	5
Our Chicago Letter	5
Our Washington Letter	5
Our Buffalo Letter	5
Personal	5
Telephonic News	6
Mr. Storrow on the Decision of the Commissioner of Patents in the Telephone Case	6
Earthing Lightning Conductors by Means of Gas and Water Pipes	6
Telephones Burned Out	6
Action of a Magnet on Chemical Action	6
Interesting Points on Overhead Wires	6
Lightning Conductors	7
Telegraphy Puzzled Him	7
Her First Telegram	7
Damages Because of a Lost Telegram	7
Money Netted from Patents on Little Things	7
Changes in the Missouri and Kansas Telephone Company	7
Telegraphic	7
Electric Power.	8
A Statement by Mr Frank Ridlon, of Boston	8
New Electric Light Station	8
Electric Light Companies at Providence United	8
Electric Stocks in Boston	8
Insurance Officials Visit Electrical Establishments	8
A Card from the President of the Julien Co.	8
The Dallas Electrical Society	8
General Electrical News	8
The Burlington, Vt., Electric Light Plant	8
Electric Railways at Wilkesbarre, Pa., Steubenville, O., and Asheville, N. C.	9
Electric Light News	9
Kindred Interests	10
Electrical Patents	10

The Massachusetts Legislature has been asked to pass telephone rate regulation bills, but it is most improbable that any of them will become laws during this session.

The Boston *Herald* learns that a Boston electrician has succeeded in making a carbon filament that will give from 33 to 50 per cent. more light from the same current than the ordinary 16-candle power lamp by its side in the circuit will emit. He somewhat selfishly keeps his preparation of the carbon filaments to produce this effect a secret!

The stock of the Westinghouse Electric Company seems to have been very popular last week. Starting in the thirties at the beginning of the week (par being fifty), it rose rapidly each day until the par-line was reached and passed. Even then, little was offered for sale. Holders are talking of much higher figures as being justified by the enormous business flowing in on the order books. Rumors of consolidation are still rife, and have something to do with the feverish condition of this stock.

There will be a great attendance of electrical people of the United States at the Paris Exposition.

A new process of manufacturing aluminum is reported in successful operation in a Western city. The owners are stated to be producing a 98 per cent. pure metal and selling it at $6 per pound.

The announcement of the resignation of President Howard L. Stockton of the American Bell Telephone Company will be received with regret by the telephone fraternity. He was a very popular and capable official, and has made many warm friendships among the telephone people of the country. As yet the name of his successor has not been announced.

The Eiffel tower in Paris is almost completed, the pinnacle structure being now in course of finishing. The electric lights will soon be installed, and it will be interesting to note the effect on the environment by large lights at such a vast height. It will also probably be effective in determining many useful facts about lightning. Courageous spirits will be called for, however, to brave that height in the midst of a severe electric disturbance, and we predict that many will be forthcoming.

The latest action of the New York Assembly in the matter of telephone legislation is in the direction of a reduction of rentals in this city alone, leaving the great Empire State undisturbed. This evidence of some wisdom on the part of our local law makers leads to the hope that they will yet realize that it is good business sense to drop the whole matter. Every man who needs a telephone can afford one at the present rental which is reasonable and equitable when the facilities it commands are considered.

Our energetic but hasty young Mayor, Mr. Hugh J. Grant, spoke like a demagogue when he censured the telephone company of New York, saying: "It could well afford to bury its wires because it charged such exorbitant rates." Such statements are catchy with the unthinking, but voting, public, but are neither dignified nor fair. The Metropolitan Telephone and Telegraph Company has spent between $700,000 and $1,000,000 putting down underground cables, and in fact has done more in this direction probably than all the telephone companies of the United States combined. Yet, Mayor Grant, if correctly reported, makes an impossible demand in a manner far from pleasant, and has taken a stand from which he will have to recede or disturb and destroy electrical service in New York city.

Although the lectures delivered before the Electric Club this season have been of more than usual interest, yet with the exception of the last one, they have been almost without experimental demonstration. On Thursday evening Prof. Robert Spice delivered a most interesting lecture before the club on the subject of "Light and Color." Speaking fluently and without notes the Professor rapidly summarized the phenomena of refraction, illustrating, as he proceeded, with a most complete set of experiments upon a beam of light from an arc lamp. Treating this portion of his subject as an introduction to what was to follow, he entered upon an elaborate and beautifully executed set of experiments upon the always interesting subject of dispersion of light.

The experiments which he performed to demonstrate that the color we call yellow is due to a two-fold mental impression, a harmonic upon the optic nerve as it were, and also the experiments upon the persistance of vision, called forth enthusiastic applause. In fact, several of these experiments were new, never—so far as we know—having been shown before outside of the laboratory. The lecturer was given the closest attention throughout the entire evening, for although his subject matter was familiar, it is not often that our audience has the pleasure of witnessing physical experiments so skilfully performed, nor enjoys the intellectual recreation of following so orderly an argument based thereon.

THE COPPER QUESTION.

It would seem that the fate of the syndicate organized abroad to control the copper market is but a question of a few months when it may be expected to collapse. The electrical interests of this country have a good deal at stake in this matter, as copper so largely enters into many departments of their work.

The average price per pound of lake copper for the last eight years is as follows: In 1880 it was 20⅛ cents per pound; in 1881 it was 18⅛ cents per pound; in 1882 it was 18½ cents per pound; in 1883 it was 15⅞ cents per pound; in 1884 it was 13⅞ cents per pound; in 1885 it was 11⅛ cents per pound; in 1886 it was 11 cents per pound; in 1887 it was 11⅝ cents per pound; in 1888 it was 16⅝ cents pound; and for January, 1889, it was 17⅛ cents per pound; for February, 1889, it was 16⅜ cents per pound.

It will be seen that the price of copper had been gradually going down until the syndicate was organized last year. Considering the demand and uses to which copper can be put, we think the price per pound, average production considered, will be about 12 cents, possibly one or even two cents less, as its production becomes less expensive. The following editorial on the copper trust is from the New York *Tribune* of March 13th:

"Having engaged in a foreign conspiracy against the people by whom protection had been granted, copper producers are entitled to no sympathy whatever if the result is disastrous to them. It will be a matter of great regret if disaster comes to the working people engaged, and to thousands in other industries whose fortunes ultimately depend upon those of the copper producers. But the mine owners who have been for many years defended in control of the home market, and then combined to deprive American consumers of the legitimate fruit, and joined French monopolists in making copper artificially more costly, must expect that American consumers will shed no tears when the combination ends in ruin. The protectionist rejoices that once more the tariff proves its power to benefit the people, and its efficiency to smash combinations that try to rob the people of its results.

"There is much talk of the reconstruction of the French bank, which was wrecked by engaging in this conspiracy, and the reorganization of the syndicate under better management. If innocent parties can be saved from harm, very well. But no power exists to avert the tremendous fall in copper which naturally results from an increase in production far beyond the natural demand, and from a vast accumulation of unsold stock. It is supposed that the world consumption prior to the last year may have been 200,000 tons; last year the production was 260,000 tons, the consumption fell to 160,000, and the accumulated stock is now about 150,000 tons—nearly a whole year's consumption. A syndicate powerful enough to hold this stock indefinitely would still be wrecked, unless it should lower the price so far as to raise the annual consumption far beyond what it was two years ago. No financial or business management will prove equal to the performance of an impossibility, and the capitalists who undertake it will have to face their loss."

FAILURE OF THE COPPER SYNDICATE.

Since writing the above, despatches have been received from London and Paris stating that the foreign copper syndicate has become utterly demoralized. Paris is said to be on the verge of a panic. Boston and New York are greatly excited over the news. The despatch states:

"There is no longer any doubt that the Societe des Metaux has gone to the wall and the Comptoir d'Escompte, per consequence, falls into the hands of a receiver.

The great house of Tavande & Co., at Mons, has suspended payments. Their liabilities are way up in the millions.

Morrison, Keekervick & Co., to whom 6,000 tons of copper are deliverable, have confessed their bankruptcy.

The most useful of metals has fallen in price from £70 per ton to £38 for spot and £35 for futures.

Even such great fortunes as those of the Agassiz family are supposed to be in danger of serious diminution as a result of the fall in their investments in copper mines."

The result of this failure cannot be fully appreciated as yet. It will certainly cheapen copper, and unsettle the market for some time to come.

NEW BOOKS.

"Economic Value of Electric Light and Power," by A. R. Foote, Cincinnati, O.

It is truly refreshing to at least see this subject taken hold of and presented to the public from a commercial standpoint, stripped of the multitudinous technicalities and scientific disquisitions which are so apt to come from the pen of an author in discussing this and kindred subjects. The book takes up the commercial side of the questions involved in electric light and power installations, and is deliciously silent on the individual enterprises of the manufacturers of the various types of plant, both electrical and mechanical. The reader is not confronted at every second page with time worn cuts and descriptions of apparatus which are not wanted, but find instead a lot of valuable information bearing directly upon the subjects under treatment.

A remarkable showing is given of the changes in electric lighting apparatus and supplies by a table of prices of to-day compared with those in 1883. We quote from this:

Dynamos	Increased efficiency	25 per cent.
	Decreased cost	40 "
Incandescent Lamps.	Increased efficiency	100 "
	" life	100 "
	Decreased cost	66 "
Carbons, Decreased cost		75 "
Wire, "		20 "
Line Construction, "		20 "

The subject of safety and reduction of risk of fire is set forth in a striking manner. Electric motors and their numerous applications are clearly shown in dividend earning possibilities. Municipal ownership of electric light and power plants is carefully weighed and found wanting. It would be incompatible with a true development of the possibilities, and become merely a political magnet having a tremendous "pull."

An ably written appendix by Dr. A. V. Garratt describes the bugaboos of electrical terms so clearly that any one of ordinary intelligence can see what is meant, and find that the misty cloud of jawbreakers has after all a bright sun behind it, and once that sunlight breaks upon him things are clear and the pathway straight.

We heartily recommend the book, not alone to all capitalists interested or about to become interested in electric light and power enterprises, but to every one in any way connected with such. All will find substantial food for reflection and incitement to investigation and comparison between what may be called the old world of commercial application of science and the new era where intelligence and improvement lead the way.

"The Electrician" Electrical Trades' Directory and Handbook, for 1889, formerly the Electricians' Directory and Handbook, has just been issued from the office of *The Electrician*, London.

A glance at the table of contents shows that in addition to an alphabetical and classified directory of persons engaged in the electrical and kindred industries and trades throughout nearly the civilized world, this number contains valuable tables specially compiled, together with interesting details of the work of the past year, patent law notes and obituary notices. A new section contains a concise account of the patent law and the approximate cost of obtaining patents in all parts of the world. The foreign lists have been augmented, especially those relating to the United States. A fine steel engraving of Sir William Thomson forms a frontispiece to the biographical notices, which have also been added to, bringing the total number of pages in the book up to 600. As usual, the typography and general appearance of the work are attractive. ["*The Electrician*" Electrical Trades' Directory and Handbook for 1889. London: *The Electrician*, 1889.]

Ex nihilo nihil fit is no longer a fitting expression according to the ideas of a certain would-be inventor. He has discovered that if a motor deliver a certain number of foot-pounds per minute it amounts to a certain horse-power for that minute, and 60 times that in an hour, and 24 times that in a day. *Sic itur ad astra!*

THE NEWS.

What is Transpiring in Electrical Circles in Boston, Chicago, Washington and Buffalo.

OUR BOSTON LETTER.

Pleasantly Situated.—The New England Wiring and Construction Company, and the firm of Paine & Francis, agents of the Edison Company, are now installed in their new offices, in the building corner of Pearl and Franklin streets, where they occupy the entire Franklin street side of the second story. The rooms are very conveniently arranged and handsomely fitted up, electric illumination being, of course, one of the ornamental features. Messrs. Paine & Francis have their office at the Pearl street front, leading from a small reception room. Mr. Walter J. Paine, manager of the New England Wiring and Construction Company, has an office on the Franklin street side, and back of this are the bookkeepers. Mr. A. R. Bush's office is between the reception room and the stock room, which occupies the entire rear, but is still no more than adequate for the entire needs of the company.

Local Mather Installation.—Messrs. Claflin & Kimball, the New England agents of the Mather Company, have just installed a 200 light plant in the new Lincoln building, on Lincoln street. In connection with this plant, storage batteries are used, and motors are to be installed.

Electricity on the Trains.—The Johnston Electric Train Signal Co. are installing their system recently described in the REVIEW on all the trains of the Boston, Revere Beach and Lynn R. R., where it is giving entire satisfaction.

Nahant's Projected Road.—Considerable opposition has developed among summer residents at exclusive old Nahant against the introduction there of an electric street railway, and a largely signed petition was presented against its introduction there at a recent hearing on the subject. The Lynn and Boston Street Railway Co., and the Nahant Street Railway Co., both presented petitions for the right to lay tracks and operate by electricity.

Complimentary Banquet.—A number of Boston gentlemen who were the guests of President F. A. Gilbert, of the Boston Electric Light Co., on a recent trip to Chicago, returned the compliment Monday night by banqueting Mr. Gilbert at Young's Hotel. Among Mr. Gilbert's entertainers were several members of the Board of Aldermen, Senators Crosby and Pillsbury, Horace G. Allen, president of the Common Council, Councilman David F. Barry, Colonel Benjamin Lovell, and Hon. Hugh J. Toland, superintendent of lamps.

Excursion of Electric Club.—The Electric Club had a very enjoyable time on Wednesday evening when they were the guests of the Thomson Electric Welding Co., at Malden, to witness an exhibition of welding by electricity. Mr. Royce and Mr. Stuart were indefatigable in their efforts at making the affair a success, and such it was. A handsome collation was served before the return to Boston.

The Simplex Company Moves.—The Simplex Electrical Company, of which Dr. A. F. Mason is general manager, have decided to remove their offices from Washington street to the Hathaway Building, 630 Atlantic avenue, where enlarged facilities will be granted them. Very pleasant corner offices have been chosen, and are now being fitted up, and will be ready for occupancy in a few days.

The Harvard Electric Club.—The Harvard University Electric Club has been formed, and from small beginnings is rapidly growing and destined to take its place among other stable institutions of the Cambridge University. The officers are president, J. Hale, Jr., L.S.S.; vice-president, E. H. Lewis, L.S.S.; secretary, L. K. Perot, L.S.S.; treasurer, A. N. Baron, '91; librarian, G. T. Page, '92. Meetings are to be held at frequent intervals, at which papers on electrical subjects will be read.

The Bangor Contract.—Mr. C. S. Haley, special agent of the Brush Company, reports that the Bangor contract with his company has been signed and sealed, that the machines and poles are ordered, and that work is to be begun at once. Mr. Haley has also arranged for the installation of a 30-arc light Brush dynamo at Bar Harbor, and another of the same capacity for Brunswick, Maine.

The Sawyer-Man Company have just contracted to furnish all the incandescent lights for the Boston Post Office.

Mr. W. A. Carey has just been granted a patent for a new volt meter adapted for alternating or direct currents, without permanent magnetism. T. W. S.

Boston, Mass., March 18th.

OUR CHICAGO LETTER.

Taxing Telephone Companies.—The unrest of the Indiana law makers is phenomenal. At the same time that the Legislature was wiping out the old bill, a new attack developed in the shape of a bill taxing telephone companies doing business in the state. It is claimed that it was pre-arranged, or perhaps pre-understood, between the captains of the two houses that it should be passed as a substitute for the repealed bill, and that the governor would sign it. The telephone tax bill was, with many others, crowded into the last hours of the session. A batch of bills was passed by the Senate, and some one who carried these Senate bills over to the House, by some unknown means managed to let it blow out of the basket into his inside pocket or the "cat" got away with it. The Secretary of the Senate is responsible for the delivery of all messages of whatever nature from the Senate to the lower branch of the Legislature, but this time he didn't take charge of the batch, and the particular subordinate who did, cannot now be designated. A vigorous overhauling of the messengers *et al* brought the bill up again, and it went its way, was chased through and reached the House again just in time to be saved and become a law.

Telephone Legislation in Illinois.—There may be a bill regulating telephone rentals passed by this legislature, but the distance from the most forward one to the front rank is a beautiful piece of long distance perspective; and there is no jumping claims in legislative work but on a two-thirds vote, which the honorable gentlemen refuse to give.

History of Electric Lighting in Chicago.—Ten years ago the first electric light was publicly shown in Chicago by Prof. Barrett, at the waterworks on the north side, and a report was made by him to the council who had ordered the experiment.

Rush street Bridge was the next point to be lighted. A dynamo was placed on the bridge, and six lamps were burned nightly The bridge is double, having two roadways, with space for four carriages abreast. Two lamps were placed over the tracks, near each end of the the bridge, and two amidships covered with red screens, to act as danger signals to vessels when the bridge was closed, and to the shore when the draw was open. The Lake street bridge, an almost duplicate of the former, was lighted in the same manner; then the Twelfth street bridge. By this time there was a great hue and cry for more light on the street, for the gas had become unendurable. In a cold night the poor little flame at the street burner winked as if it was in a chill stupor, and was as blue as a Quinnebog whetstone with the cold. Oh! the sad little things were so sleepy, and if the chill weather kept on for a few days, they died out by scores, and the poor benighted pedestrian, as he emerged from the shadows of a lone side street into the full glare of some friendly electric lamp that burned all the brighter as the gas sickened and died, was one of the outspoken advocates of municipal electric lights, no matter how much opposed to them before. So the sentiment grew, and by and by, with but a small amount of trumpet, and drum, and jewsharp melody, there came the river plant of a hundred and odd lights.

The Size of Chicago's Electric Light Plant.—Then the people plead for more light, when asked what they most desired, and the final result of this has been, up to date, that there are now nearly 300 city lamps burning nightly on the streets, viaducts, in the fire engine houses and police stations, on 48 miles of wire, not one foot of which is anywhere visible except on the lamps, and 12 dynamos are doing the work on circuits averaging four miles each. The poor little aguish gas flame, blue with the cold, and constitutionally feeble, which winked at us from its roost on the lamp post, over 900 of him, have winked their last wink, shook their last shudder, and retired from active life. But the whole West Side of Chicago is aflame with electrical longings. As I write there lies before me an invitation to the regular meeting of the Grant Club to-night, at which the subject for discussion is the resolution "that all the business streets of the West Side should at once be lighted by electricity," and a paper on electric lighting by a gentleman from the city electrical department, is to open the ball.

A Desirable Invention by a Philantrophist.—W. W. Smith, of Kansas City, has made the retention of heat in a coil through which an electric light current is flowing, a source of protection. It has been shown that heat may be developed in an annunciator coil by a current insufficient to melt the fusible plug, and endanger the office. So Wiley wraps a No. 36 German silver wire around a No. 6 iron core, and covers the whole completely with beeswax. Now, when there is heat enough to do mischief in an annunciator coil, the heat confined by the beeswax will melt out the German silver wire, and avert the danger. As excellent philantrophist Smith will not apply for a patent, nobody will have to steal it to use it, which is a blessing in this moral age. C. C. H.

Chicago, March 16, 1889.

OUR WASHINGTON LETTER.

New Zinc Mine.—Gen. W. S. Rosecrans is president and James M. Chadsey secretary of the Washington Zinc Company, which is to hold a meeting in Lynchburg, Va., on the 16th inst., to arrange for building works in that city for reducing the ore from their mine located near Roanoke, Va. This is a new mine, and is said to be a valuable one.

To Telegraph Underground.—The projectors of the Spaulding underground telegraph scheme plan to lay from 75 to 150 wires in a six-inch iron pipe one foot below the surface of the ground, between Washington and Boston, and intervening cities. The settlement of retardation and other troublesome questions by this experiment should be of much benefit to subterranean line constructors.

Hasty Congressional Work.—My statement last week that Congress had given no authority for the construction of lines by new companies was not correct. Just before adjournment an act was passed empowering the commissioners to "authorize the overhead wires of any telegraph, telephone or electric light company to be laid under any street, etc., in the district, whenever in their judgment the public interest may require; such privileges to be revokable at the will of Congress, and this authority to continue only until the termination of the Fifty-First Congress." Just what this law means the commissioners are in doubt, and the district attorney has been asked to interpret it. Major Raymond does not quite understand whether he can permit the laying of any wires except such as are substituted for overhead wires, or whether he can even allow wires to be placed in unused conduits already prepared for them. Congress evidently intended to authorize the laying of new wires, and the ambiguity of the law is owing to the haste with which business was transacted.

$40,000 for Electric Street Lighting.—For electric street lighting $40,000 is appropriated with the proviso that no more than 60 cents per night shall be paid for any light of 1,000 actual candle power, burning from sunset to sunrise, and no more than 40 cents for the same lights operated wholly or in part by overhead wires, and no payment can be made after September 30, 1889, for lights operated by overhead wires. The commissioners may invite proposals for future lighting, by any system, on one or five year contracts. Provision is made for seven arc lamps, on iron posts 25 feet high, connected by subterranean wires, to illuminate the White House grounds, at an expense of $2,022.

Other Electrical Appropriations.—The Signal Office gets $118,000, to pay for telegraphing weather reports. Eleven thousand dollars is appropriated to pay the Standard Underground Cable Company, for wires laid on trial in October, 1888, connecting the Capitol, Executive Mansion, and the Departments. These wires (the first Waring cables) have been in use since that date, and have proved very successful. Among other appropriations are the following items: The inauguration of electric lighting in the Navy Yards at New York, Norfolk, Washington and Mare Island, $60,000; lighting the "Miantonomah," "Terror," "Monadnock," "Petrel" and "Vesuvius" (in addition to previous appropriations), $55,000; for the receiving ship, "Vermont," $6,000; telegraph, cable and land line, to connect Tillamook light station with Point Adams, Oregon, $6,000.

Street Railways.—Street railroad legislation provides that any company authorized by law to run cars by horses, may substitute electric power by storage or independent electrical batteries or underground wire, or underground cables moved by steam power, with a stipulation that, before such change is made, the roadbeds shall be laid with a flat grooved rail and made level with the surface of the streets. Under this authority the Washington and Georgetown Road has taken steps for immediately equipping its Seventh street line with a cable plant. This is a straight road, 3½ miles long, leading from the steamship docks to the northern boundary, most of the way running through crowded business quarters. President Henry Hunt, one of the most practical and enterprising street railroad managers in the country, has thoroughly studied this question of motive power, and come to the conclusion that, in this case, the cable is the only suitable thing to use.

To Light the Senate.—Capt. Bradford has prepared plans and estimates for lighting the Senate end of the Capitol, requiring about 3,000 incandescent lamps, for $60,000, not including fixtures.

On January 1st, the city of Selma, Ala., being $5,000 in arrears to the company that is furnishing electric lights for the streets, and furnishing no prospect for payment, the company shut off its lights, leaving Selma in darkness.

At Rome, Ga., the Crown Electric Light Company has been formed it is reported, and will erect plant for incandescent lighting. C. C. M.

Washington, March 20th, 1889.

OUR BUFFALO LETTER.

The Brush Electric Light Co.—A large increase in the Brush Electric Light Co.'s business has made a number of extensive changes necessary. After May 1st the company's night system will be handled at the Elk street works. For this purpose the largest engine ever put up in this section of the country has been contracted for. It will be what is known as a compound condensing engine of the Reynolds-Corliss type. The fly wheel is 24 feet in diameter. The new engine will have 1,800 horse-power, and will generate electricity for 960 arc lights.

Electric Service Company.—The headquarters of the National Electric Service Company, recently moved from No. 120 Broadway, New York, have been established at Nos. 53 and 54 White Building. The business is growing rapidly.

The Electric Light Popular.—Buffalo business men are beginning to show greater appreciation of the electric light. The Thomson-Houston Company has put in about 45 arc lights since the first of the month, and a large number have been put in by the Brush Company. Buffalo men are losing the reputation they had gained of being rather too conservative, and the gas light is being rapidly superseded, now.

The Wires in the Air.—The electric light wires are slow in burying themselves. One company has several miles of wire underground, but the conduits prove unsatisfactory. For incandescent lights the system seems to work well, but for arc lights of over 1,000 or 1,500 volts, it is practically useless. The fire department wires are all underground, and a large number of the telephone company's wires. One of the greatest difficulties is owing to the costly trick the manholes have of blowing out on account of the collection of gas in the conduits.

Electrical Society.—Mr. Frank Kilton, of the Western Union Telegraph Company, read the last paper before the Electrical Society. The subject was "Electric Street Railways." A. C. B.

Buffalo, N. Y., March 16.

PERSONAL.

Col. Henry S. Russell, son-in-law of Mr. John M. Forbes, of Boston, is reported in a special dispatch as likely to be the successor of President Stockton.

Mr. W. B. Dowse, treasurer of the N. Y. Insulated Wire Company, was a visitor in New York last week, the guest of Mr. J. W. Godfrey at the Electric Club.

Mr. Henry D. Stanley, of Bridgeport, Conn., has been quite ill for two weeks past, unable to leave his home. His numerous friends will be glad to hear that he is now convalescent and will be able to be out again in a few days.

Mr. Cyrus O. Baker, Jr., of Newark, has been a sufferer from pneumonia for ten days past, but was able to be out this week and receive a warm welcome from his electrical friends who had heard of his severe attack of this dangerous disease.

Mr. S. Insull who has been at the head of the Edison Machine Works at Schenectady, New York, will hereafter make his headquarters in this city at 19 Dey street, and will have charge of the electric fixture establishment of Bergmann & Company, of this, city in addition to looking after the affairs of the Machine Works at Schenectady.

Mr. W. J. Denver has assumed the duty of first assistant general manager of the New England Telephone and Telegraph Company, with headquarters at Springfield, Mass. General Manager Jasper N. Keller announces that all correspondence concerning the business of the western division of the company should be addressed to Mr. Denver hereafter.

The current number of *La Lumière Electrique* contains an article on high speed steam engines, illustrating and describing among others, that made by the Erie City Iron Works; the Phœnix, made at Meadeville, Pa.; the Armstrong, made by the Western Engine Co., of New York; the Rice automatic, the Ide engine, the Armington and the Pitchford Corliss (San Francisco), America, making a most satisfactory showing, inasmuch as the above list embraces all the engines taken up by M. Gustave Richard in his article, with one or two exceptions.

⁂ Steps are now being taken to establish a telephone exchange at Albany, Ga.

⁂ Telephone wires at Denver saved the life of a boy who fell into them from the top of a nine-story building.

⁂ Among the bills introduced at Albany is one fixing telephone charges in cities of 500,000 and over at $5 per month.

⁂ A few druggists in Chicago appear to think they are the great American public in the matter of telephone regulation.

⁂ Rutland and St. Albans, Vt., are to be connected by long-distance telephone, a distance of 92 miles. Manager R. D. Beals, of Rutland, has been authorized to construct the line.

⁂ President Howard Stockton has resigned from the American Bell Telephone Company, to accept the treasurership of the Merrimac Manufacturing Company, to which he has been elected.

⁂ Mr. George H. Glass, of the Southern Bell Telephone Company, is in the town of Durham, N. C., working on the Durham telephone exchange, which he promises to have ready for operation in a few days.

⁂ The directors of the American Bell Telephone Company, met March 13th, and declared the regular dividend of $3 per share, payable April 15th, to stockholders of record March 30th. The books will be closed from April 1st to April 13th. The books will be closed for the annual meeting which occurs on the 26th inst., from March 21st to 26th. No action on the election of a successor to to Mr. Stockton is probable until after the annual meeting.

⁂ The Highland Improvement Company of Helena, Ark., is negotiating with Manager Fowler, of the Erie Telegraph and Telephone Company, for the erection of lines between that city and Memphis and between that city and Friar's Point and Grenada, Miss. The Mississippi river will be crossed by a cable and all of Western Mississippi and Eastern Arkansas will thus be connected by a thorough system of telephone communication. The design is to connect all of the towns along the line of Louisville, New Orleans and Texas Railway in Mississippi, and along the lines of the Arkansas, Midland and St. Louis, Iron Mountain and Southern Railway in this State, both with Helena and Memphis.

⁂ The Bell Telephone Company of Philadelphia has awarded the contract for the erection of a permanent central office at Nos. 406 and 408 Market street. The new building will be a handsome affair and in keeping with the many massive structures that have reared their heads in the business section of Philadelphia in the past few years. The company will spend $75,000 for a new multiple switchboard in the new building. In a month or less it will continue work on the subway on Market street, which is designed to hold all the wires that are now overhead on that and adjacent streets. The subway extends from Front to Eleventh streets, and will be continued out Market street to the Schuylkill River. It will make a detour around the City Hall, via Thirteenth, Arch and Fifteenth streets. Most of the work will probably be completed within the present year. The idea is to have small conduits extending from Market street on every alternate street, so that all overhead wires may be carried through them to a tall pole in the center of a block and then distributed to the buildings within the block. This work is designed to bury all the wires between the two rivers and Vine and South streets, and will entail a cost of $1,000,000. The Western Union Company's wires will also be carried in the same subway and conduits.

Mr. Storrow on the Decision of the Commissioner of Patents in the Telephone Case.

The following interesting letter from Mr. J. J. Storrow, the chief attorney of the American Bell Telephone Company, was written to Mr. John Bigelow, and will interest every one of our telephone readers:

BOSTON, Mass., February 25.

Dear Mr. Bigelow: I think you take interest enough in telephone matters to care to know the importance of the decision which the Commissioner of Patents made on Saturday, February 23.

The principal charges in the Government bill against us—those on which it was ordered, those on which it appealed to the public favor, and those on which the Supreme Court has sustained it—are charges of various frauds and malpractices in the Patent Office, and charges that Bell knew of the Reis telephone, and that it was a speaking telephone, and drew his own specification so blindly that it could not be understood, and got it through the Patent Office in that way. There are no charges in the bill that anybody actually ribed any officer of the Patent Office.

Before that bill was brought, Gray, under the guidance of the promoters of it, filed a motion in the Patent Office asking that all the interferences which had been decided in Bell's favor should be reopened, the decisions set aside, and the matters newly tried upon the grounds that the frauds which are now alleged in the Government bill had been committed, and that the decisions in the interferences were got by trickery and collusion; and he alleged that he had new and valuable testimony bearing upon all the matters in dispute. A year later, and a few days after the present bill was filed, McDonough, another defeated contestant in the interferences, and who is set up by the Government bill, filed a similar motion.

The first hearing on these was in March, 1887, before Commissioner Montgomery, and one of the counsel for McDonough was Mr. Jefferson Chandler, a special Government counsel in the suit against us. Those cases came on to be heard finally on their merits February 1, 1888. By consent, the attacking parties were allowed to use any of the evidence which was laid before the Attorney-General and the Secretary of the Interior, on which to bring the suit against us, and they introduced a number of other affidavits. The cases were argued orally for eight consecutive days. For the Bell Company there was Mr. Conkling and myself—it was the last case, I believe, that Mr. Conkling argued. For McDonough there appeared on this occasion Col. Ingersoll and Mr. Frank Hurd, ex-Congressman from Ohio. For Gray there appeared Mr. Philipp, a well-known and very able lawyer of New York, and Mr. Casey Young, secretary and attorney of the Pan Electric Company. The reported briefs and arguments made nearly 1,000 pages of print. The Commissioner has kept the case under advisement for nearly a year, and has now written an opinion which covers nearly 150 foolscap pages. He has taken up every one of these charges, and decides that there is not the slightest ground for them, either on the old evidence or on the new, but that, on the contrary, the proof is affirmative and plenary, and that there was no malpractice of any kind whatsoever, either in procuring the patent or in trying the interferences. He decides that the interferences shall not be reopened, because they were well tried and there is no ground for assailing them, and also because, on a review of the old evidence, with the additional and so-called new evidence, the decision must still be in favor of Bell beyond any reasonable doubt.

In short, while a year or two ago the United States, by its Attorney-General, who does not know anything about such matters, alleged that an inquiry ought to be made whether its Patent Office had not been cheated, now the United States, by the head of its Patent Office, declares that it has brought the parties before it, has made that inquiry with extraordinary care, and has made it, says the Commissioner, in the interest of the public as well as between the parties themselves, and finds as a result of that inquiry that there was no fraud or malpractice whatever.

It is difficult to see what moral or legal ground the Government now has to stand on against us. If the same influences prevail in the future in the Department of Justice as before—by which I mean if either Mr. Garland or Mr. Jenks were to stay—their personal feeling would keep the suit going against us, no matter at what cost to the Government nor with what little chance of success.

This conclusive establishment that there is no fraud leaves the assault against us in rather a curious predicament. It was intimated to us a month or two ago that the promoters of the suit and the Attorney-General's department had now no hope of making out any charges of fraud; but they thought that if, on some pretence, they could get the Drawbaugh case again before the Supreme Court, the change of two of the judges might give them a chance, and at any rate they could not suffer anything worse than defeat, and it would cost nobody anything, except the Government. That is their whole hope in this case. Unfortunately for that hope, the Circuit Court in this case, as all other Circuit Courts have done, have decided that if the United States can maintain a suit to cancel a patent at all, it could only do it where there is fraud. The Supreme Court in this case decided that this bill stated a case because there were allegations of fraud, and that they would not decide whether it could be maintained if there was no fraud.

So, the plan of the present Solicitor-General, who is personally very bitter on the subject, is, unless he changes his views, to spend a quarter of a million dollars of the public money in taking the evidence about all the alleged prior inventors, in the hopes that after he has done it and spent the money, the Supreme Court may be willing to receive it, and if they receive it, may be willing to reverse their former decision on the facts; and he proposes to do all this for the sake of personal feeling, because it is hardly possible that the testimony, if taken with the fulness the various defences have hitherto developed, could permit the case to be finally disposed of by the Supreme Court before the expiration of the patent.

I send you with this a copy of the plea of Mr. Bell, filed to-day in the Government suit, in which he takes issue on the question of fraud, and then says that if the question of fraud is tried and decided in his favor, the case ought to be stopped there; and the answer of the Bell Company, in which they take issue on everything.

Yours truly, JAMES J. STORROW.

Hon. JOHN BIGELOW.

Earthing Lightning Conductors by Means of Gas and Water Pipes.

It is generally assumed that the path of the discharge follows only the line of least resistance, and no attention has been paid to the fact, on which the author insists, that the direction of the discharge is chiefly influenced by the state of electric potential of the buildings in the closest proximity to the charged cloud. The better the connection of the metallic masses in buildings is with the earth, the higher will be the potential of the induced electricity, and the greater likelihood is there of a discharge taking place between the cloud and the points in question. Since the general introduction of gas and water pipes into our houses, it is these which offer the least resistance between the roofs and the earth. Hence, if a charged cloud should pass over such a house, the gas and water pipes must be at a higher potential, and there is much greater probability of the lightning entering the house through them than at any other point. In other words, it is more likely that the discharge will take place through the pipes than through the lightning conductor; and if the lightning rod is not connected to the pipes, the discharge will find its way somehow to the latter, causing destruction in its path.

At the request of the Hamburg Fire Insurance Companies, the author undertook to inspect cases of lightning-strokes, and to ascertain the point struck, as well as the path followed. A great many interesting cases investigated are duly recorded, but some general results only can be reproduced. It generally happened that, when the building struck was unprovided with a lightning conductor, the lightning struck some part of the roof or walls, found its way to the gas and water pipes, and then passed harmlessly to earth. In the few cases where lightning struck a building fitted with a lightning conductor, the discharge jumped over from the conductor to the pipes. In 15 cases which were specially investigated in the years 1884 and 1888, after the lightning had done more or less damage at the point where it struck, and in the immediate neighborhood, it was found that in nine cases the discharge made its way to earth through the water pipes, in two cases through the gas pipes, in two cases through rain pipes, in one case probably through the lightning conductor of a telephone line on the next house, and in one case through an iron crane. In all cases where the pipes were the conductors, the path of the discharge could be clearly traced up to them, and then ceased. One of the cases of discharge through the gas pipes occurred in an ordinary dwelling-house provided with a lightning conductor, from which the discharge had passed over a distance of about two metres to the pipes; subsequent tests showed that the conductor-earth had a resistance of 138 ohms. In no case was any damage done to the pipes by the discharge occurring through them.—*Elektrotechnische Zeitschrift.*

Telephones Burned Out.

Superintendent Grant, of the police patrol service, Cleveland, went out to string a wire to the new police station in the Eleventh precinct, on Euclid avenue, near Fairmount street. One of the linemen dropped the wire from the top of a pole down upon the line carrying the current of electricity for the motor cars. The result is said to have been the burning out of a number of telephones at the East End within a very few seconds. It has not been determined where the responsibility should rest, although it is said suits for damages will follow.

Action of a Magnet on Chemical Action.

Two small pieces of iron wire were embedded, side by side, in an insulating medium, and were connected to a galvanometer; the whole was placed between the poles of a powerful electro-magnet in a small beaker, which could be filled with any liquid. The end of one piece of wire was bared of insulation and filed to a point; the other piece was laid bare on a portion of its side. Various liquids capable of acting chemically on iron were tried, ni ric acid giving the best results. The experiments tend to show that the magnetic field has a protective action on the iron, this being more especially the case when the attacking liquid does not evolve hydrogen. The most complete protection occurs where the iron has points from which the lines of force can radiate. Thus, if there is a particle of iron rather harder than the surrounding ones, this will be less attacked, and will result in a little elevation from which the lines of force diverge, still further shielding it, so as to produce ultimately a small ridge. Nickel and cobalt show the same phenomenon, but in a less degree than iron.

Interesting Points on Overhead Wires.

The committee on street railways of the Massachusetts Legislature has been taking a good deal of testimony of late in relation to overhead wires. Mr. Charles J. H. Woodbury, representing a large number of insurance companies, and a well-known able electrical engineer, testified that he had occasion to investigate this subject for many years, and that he had himself received even an electric light current several times without injury, and had known of other similar cases; that he had investigated the matter of storage batteries and conduits, but believed in the present state of the art they were inferior to the overhead system for any electrical purpose. He expressed the opinion that the demands of the travelling public for transportation in Boston had already taxed the capacity of the horse railroads, and that the only feasible method of filling that demand was by the application of electricity, and that such methods should be used as had already been shown by the experience in Boston to contain in the highest degree the capability of continuous operation, especially in stormy weather, when there is the greatest demand for transportation.

William D. MacQuesten, electrical engineer for the West End Street Railway, and who built the Brookline and Brighton systems, stated that he had been in the electrical business since March, 1881, and had received the full current from overhead wires many times. He had twice taken the current in Brighton without any injury whatever except a slight shock, and stated that employés under him in Brighton had taken the full current in 13 instances, but were able to resume work inside of five minutes; that at several times he had been connected with electric roads, and had known of repeated instances of similar shocks to other employés, but never knew or heard of any injury whatever resulting from them. In all those cases the voltage varies from 300 to 600. He had at one time received a 1,200 volt current himself from one of Mr. Edison's machines, with which he was experimenting. The shock in this case was more severe, and he felt it for about an hour. From experiments made upon animals while he was with Mr Edison, it appeared that the frog was the most sensitive, the cat the second, and the horse the third, and he thought animals would be in greater danger from the underground than from the overhead system. It did not appear from his or any other testimony that any person other than an employé at work upon the Boston electric railway line had ever received a shock.

Lightning Conductors.

The author first deals with the vexed question of using gas and water mains as "earth," and then passes in review some simple apparatus for testing the resistance of lightning conductors.

From actual experiments he has found that the resistance of an "earth" formed by gas or water pipes is less than that of the usual earth-plates. In all buildings protected by a system of lightning rods, the conductors must in some part or their course come into proximity to some portion of the metal pipes; and since the resistance of the "earth" of the conductor is greater than that of the pipes, the electric current, even though it may for some distance traverse the conductor, has a tendency to leap across the pipes. There is, therefore, every reason for connecting the conductor from the lightning rod to the gas and water pipes. The way in which the joint between the conductor and the main is made is not of great importance; the two essential points are that the two shall be in thoroughly good metallic contact, and that the joint shall have a fairly large surface. The connection may be made at any convenient spot, provided that, if the pipes are of iron, the section of metal between the joint and the "earth" shall nowhere be less than 100 square millimetres (0.155 sq. in.); and if of lead, five times as large. Meters, whether gas or water, should be short-circuited by a length of stranded copper wire.

The nature of the joints in the pipes is of some importance; but actual experience has proved that there is no risk of danger to the pipes if the joints are soldered, screwed, flanged, or spigot joints filled in with lead. In the town of Hanover a great number of "earths" made by means of the gas and water pipes have existed for over 10 years, and no damage has resulted from their use. There is not much to choose between gas pipes and water pipes, though gas engineers have raised objections to the use of the former on the ground of the resistance which must be introduced at the joints by the use of red lead.

Some actual measurements are of interest. The first series was carried out in the High School at Hanover, on the gas pipes in the building, some of which had been put up seven years previous to the time of testing, and others three years. The total length of pipe tested was 75 metres, in which there were 117 joints, all made with red lead. The total resistance was found by experiment to be 0.12 ohm; the resistance of the pipes themselves, as calculated from their section and length, was 0.086 ohm, thus leaving 0.034 ohm as the resistance of the 117 joints, or a mean of 0.0003 ohm per joint. It appears, therefore, that screwed joints in iron pipes made with red lead give a sufficiently good metallic contact.

The second series of experiments was carried out on large gas mains with the usual spigot joints, made gas-tight by molten lead being run in. In order to obtain the resistance of the pipes alone, advantage was taken of a main existing in the gas works at Hanover, which was not buried, but rested on a wooden flooring. This served also as a road for the trucks laden with coal and coke, and consequently the pipe line was exposed to much vibration, which seems to have loosened the joints, as very varying resistances were obtained—*e. g.*, 0.015, 0.04, 10.4, 420, 0.07, 4.4, 55, 26, 40 and 61 ohms respectively. Six lengths of pipe of 10 cm. outer diameter were put together specially, and the resistance of the five new joints was found to be only 0,009 ohm. The resistance of the joints is, however, of secondary importance in the case of gas mains buried in the ground, as, owing to their large surface, the "earth" resistance of even the first length or two will be much less than that of a joint, so that the current will be earthed before it has to traverse more than one or two joints.

The second portion of the paper deals with several new portable testing apparatus, which have been devised and manufactured by different firms, and which comprise batteries, magneto machines, bridges, galvanometers and telephones, for use with both continuous and alternate currents.—*From Elektrotechnische Zeitschrift.*

Telegraphy Puzzled Him.

A man who had never seen the inside of a telegraph office wandered into that of New London the other day, and as some one came in with a message, asked to "see it go." He was taken inside and gratified, but was not inclined to believe that a message was really sent by the clicking key. "Finally," says the New London *Telegraph*, "Manager Smith built a short circuit in the operating room, with operator Costello at one end and the old man and the manager at the other.

"Then Mr. Smith requested the old fellow to whisper something to him and he would send it to Costello. He did so, but when he saw his words written out at the other end of the short circuit he claimed that Costello heard him when he told Manager Smith what to send. Mr. Smith suggested to him that he should write in paper what he wanted to say, and then he could convince himself that there was no 'shenanagin' about it. The old fellow did so, and Mr. Smith sent it to Costello, who returned the words on paper. Even then he could hardly be convinced, but he concluded that 'it was the durndest thing he ever saw.' He spent half an hour in the office and furnished a great laugh for the operators and messenger boys. He hailed from Ledyard, and had never been in a telegraph office before."

Her First Telegram.

IT WAS SHORT AND TO THE POINT, BECAUSE DISPATCHES COST, YOU KNOW.

"Be sure to telegraph me as soon as you arrive," said a young husband to his bride. She was starting on her first trip home to see her mother. Her mother lives about ten miles out of Philadelphia.

"I will," promised the young wife sweetly; "but I don't know whether I have money enough."

"Oh, send it 'collect.' Now don't forget. Good-by."

"Good-by."

"Good-by."

The young husband gazed longingly after the train as it steamed out, and then he sadly returned to his place of business. In half an hour a messenger boy presented the following:

"FROG CENTER, PA., 2 P. M.—George Washington Blank, 43 Blank street, Philadelphia—My Dear George: I have just arrived safely without any accident at all; not the slightest. The train slowed up at Jinks crossing and whistled, but I don't think anything serious was the matter. It made my heart jump to think how you would feel if anything had been the matter, you know, but there wasn't, not a thing, so far as I could find out. I got to thinking of you and might have been carried past my station if Cousin Will, the one you used to be so jealous about, you know, hadn't been on the train. He is visiting at mother's, and is handsomer than ever. He says he hates you, but of course, that's only fun, you know. I forgot to say that my trunk came through all right. It was no trouble at all. Cousin Will took my check and arranged to have it (the trunk, you know,) hauled up to the house. It will have to be taken around by the mill because the other road is blocked up, you know; but, you know, that will only take a few minutes longer than by the other road—the one that is blocked up, I mean. Well, I must close this dispatch, because telegrams have to be short, you know.

Your loving wife,

"ANNIE BLIFKINS BLANK."

[Collect $10.]

*** President Payne, of the Wisconsin Telephone Company, Milwaukee, estimates that the cost of burying the telephone wires on the business streets of the East Side, south of Wisconsin street, will amount alone to $100,000. This work will be done this year, the company being prepared to commence burying the wires as soon as possible after the ordinance pending in the common council shall take effect. The company will not do any work this year, except that outlined, the system being very expensive.

Damages Because of a Lost Telegram.

William Boyd, of Philadelphia, has brought a suit for $5,000 damages against the Western Union Telegraph Company. He alleges that on January 13 William Garretson, of New York, sent a telegram offering him a position as second engineer on the steamer "Aguan," running to Mediterranean ports. The telegram was not delivered until the evening of February 4. The steamer had then sailed and Boyd lost his job. He is now working as a helper at Cramp's shipyard for about $14 per week. The job he lost was worth about $100 per month.

Money Netted From Patents on Little Things.

(*From the Inventor.*)

The rubber tip at the end of lead pencils has yielded $100,000 in England. A large fortune has been reaped by a miner who invented a metal rivet or eyelet at each end of the mouth of coat or trousers pockets to resist the strain caused by the carriage of pieces of ore or heavy tools. In a recent legal action it transpired in evidence that the inventor of the metal plates used to protect soles and heels from wear sold upward of 12,000,000 plates in 1879, and in 1887 the number reached 143,000,000, producing realized profits of $1,250,000.

As large a sum as was ever obtained for any invention was enjoyed by the inventor of the inverted glass bell to hang over gas to protect ceilings from being blackened, and a scarcely less lucrative patent was that for simply putting emery powder on cloth. Frequently time and circumstances are wanted before an invention is appreciated, but it will be seen that patience is well rewarded, for the inventor of the roller skate made over $1,000,000, notwithstanding the fact that his patent had nearly expired before its value was ascertained. The gimlet-pointed screw has produced more wealth than most silver mines, and the American who first thought of putting copper tips to children's shoes is as well off as if his father had left him $2,000,000 in United States bonds.

Upward of $10,000 a year was made by the inventor of the common needle threader. To the foregoing might be added thousands of trifling but useful articles from which handsome incomes are derived, or for which large sums have been paid.

Few inventions pay better than popular patented toys. A clergyman realized $2,000 a week by the invention of a strange little plaything to be seen for a long time in every toy shop window, and even in the streets of London.

That favorite American toy, the "return ball"—a wooden ball with an elastic attached—yielded the patentee an income equal to $50,000 a year, and an income of no less than $75,000 per annum to the inventor of the "dancing Jim Crow."

The invention of "Pharaoh's serpents," a toy much in vogue some years ago, was the outcome of some chemical experiments and brought the inventor more than $50,000.

The sale of the little wooden figure, "John Gilpin," was incredibly large for many years, and a very ingenious toy, known as the "wheel of life," is said to have produced upward of $500,000 profits to its inventor. One of the most successful of modern toys has been the "chameleon top," the sale of which has been enormous. The field of invention is not only vast and varied, but it is open to everybody without respect or favor of any kind to sex or age, station or means. The merest trifle may be the key to a fortune if it be an article that the public actually wants in great numbers.

Changes in the Missouri and Kansas Telephone Company.

The stockholders of the Missouri and Kansas Telephone Company met at Kansas City, Mo., Thursday, March 14th, and elected A. O. Morgan, of Boston, in the place of George L. Phillips, of Chicago, deceased. The directors met afterward and accepted the resignation of C. D. Crandall, who has been the very efficient secretary and treasurer since the company was organized in 1882, and who now goes to Chicago to accept an important position with the Western Electric Company. W. W. Smith was elected secretary, and N. R. Ferguson, treasurer, both having been long connected with the company.

TELEGRAPHIC

.... Mr. T. W. Parks, of Tyler, Texas, has been appointed superintendent of telegraph of the I. & G. W. R. R. His headquarters will be at Tyler.

.... A bill has been introduced in the Ohio Senate taxing telegraph and express companies on value of property in mileage in the State. Thos. McDougall, of Cincinnati, is the author of the bill.

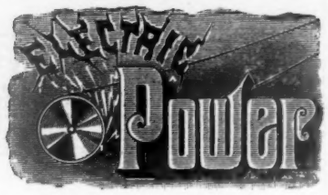
.... The State telegraphs in England still fail to meet expenses. The outlay last year exceeded the receipts by more than £6,000; and there was still interest to pay upon a loan of £10,880,571. The total deficiency amounts, therefore, to no less a sum than £332,501. Since 1872 the country has paid in taxation towards the working of the telegraphs the enormous sum of £3,357,400.

.... The following statement shows the amount of business handled by the Washington office of the Western Union Telegraph Co. during inauguration week and upon inauguration day: February 27 to March 5, inclusive, press, 1,467,583 words; messages, 126,427; inauguration day, press, 614,982 words; messages, 29,194. This is more than double the amount of matter ever handled by this office in any one day previous to this time. The total amount of press matter sent out from Washington on March 4 by all the telegraph companies and leased wires was 855,182 words.

.... The directors of the Western Union Telegraph Co. met in New York March 13, and delared the regular quarterly dividend of 1¼ per cent. The revenue for the quarter ended December 31st was $1,685,807, out of which $1,289,712 was paid for interest, sinking fund and dividend charges, leaving a net surplus of $396,807. For the current quarter ending March 31, the earnings are estimated at $1,350,000, the interes , sinking fund and dividend requirements amount to $1,285,945, leaving a surplus of $64,055 and making the total surplus after paying the dividend just declared of $8,883,908.

.... The South Atlantic Telegraph Company of Baltimore City, Md., has been incorporated with a capital stock of $50,000. It is said that the new company is to form a link in the Mackay-Bennet Postal Telegraph and Cable Company system, and is for the purpose of purchasing and owning the lines of that system in Maryland now only leased. The scheme embraced amalgamation with the Southern Telegraph Company of Virginia, the Southern Telegraph Company of North Carolina, and the Southern Atlantic Telegraphic Company, whereby lines of wire may be secured extending to New Orleans, and covering the entire south and southwest. The entire system is to be controlled by the Mackay-Bennett management.

.... A despatch from Washington to the Boston *Journal* contains the following novel telegraphic news: "A long distance underground telegraph cable is being laid between this city and Boston, Mass., by the Spalding Telegraph Company. General Manager John G. King submitted a form of application to the Commissioners yesterday for the necessary permits to enter this city with the cables. His letter states that Washington, Baltimore, Wilmington, Philadelphia, New York, Boston and other cities will be connected, and they will be given much more constant, uninterrupted and cheaper service than is possible by overhead wires. The cable will be laid in a six inch cast iron pipe, laid one foot below the surface of the ground, and will contain from 75 to 150 copper wires, each insulated. The necessary stations and turnouts will be put in at various points for the accommodation of other cities."



* * The Brooklyn City Railroad is strongly considering the question of electric power.

* * Kansas City, Kansas, is to have an electric railway on Third street. The line will extend to Quindaro.

* * The electric street railway is progressing finely at Raleigh, N. C. The plan is to have the wires in conduits.

* * The right of way has been granted to construct an electric railway to a company, who have applied for a charter, at Concord, N. C.

* * Electric lights will soon be placed in the State Normal School at Brockport, N. Y. Two hundred and twenty lights of 16 and 20 candle power will be used.

* * The Naumkeag Street Railway Company, of Marblehead, Mass., is making preparations to run all its cars with electric power. The cost of equipments is estimated at about $100,000.

* * The Brunswick Milling Company is putting electric machinery in the Jimmie Mack mine, near St. Elmo, Colo. The power is furnished at the mill which is a half mile from the mine.

* * Steam and electricity were the subject of debate at the Railroad Men's Literary Club in Atlanta, Ga., and after a lively debate the judges decided in favor of steam. The able abvocates of electricity will not have long to wait, however.

* * Inside of sixty days, if there is no break in the plans already laid, Madison, Dak., will be illuminated by electric lights. Twenty arc lights and about 150 incandescent lights will be put on at once. The capacity of the plant will be twice that number.

* * The work of excavating for the new building for the Westinghouse incandescent station of the Missouri Electric Light and Power Company's building at Twentieth and Locust streets, St. Louis, is progressing. The building will be 137 feet 6 inches by 86 feet, and one story high with a truss roof. The plans now being executed are for a 75,000 light plant.

* * The South Park Railway Company has been incorporated in St. Joseph, Mo., with $100,000 paid up capital. It will build an electric line through the south part of St. Joseph, from east to west, connecting with the Union line at Sixth and Patee streets. The directors are: John Donovan, Joseph Hansom, Ben Frazer, J. D. McNuley, J. C. Madinger, Jas. Craig, Jr., and Jas. Pfeiffer.

* * Senator Raines and Assemblyman Hamilton have introduced a bill in the New York Assembly providing as follows:

Section 1. The Niagara Hydraulic Electric Company, a duly incorporated company, is hereby authorized and permitted to erect all the machinery for manufacturing electricity under the waterfall at Niagara Falls in such a manner as may be necessary, by extending pipes or receivers, and such machinery as may be required under said falls to connect with and receive the water where it passes from the said falls, but not in any way to deface the falls.

Section 2. Said company is hereby authorized to cross the lands of the State adjacent to said falls with all necessary machinery and appliances, and shall furnish electricity to illuminate the park and the falls under the direction and control of the Commissioners of the State reservation of Niagara.

Section 3. Said company is hereby authorized and permitted to erect one or more shafts or elevators for the purpose of raising or lowering machinery for said manufacturing purposes.

Section 4. This act shall take effect immediately.

A Statement by Mr. Frank Ridlon, of Boston.

To the Editor of Electrical Review:

I beg to trespass upon your space that I may bring before the electric light fraternity, more especially those who attended the late convention in Chicago, an explanation—or, I should say, a vindication—of what I said on the floor of that convention on the second day of its session, regarding the condition of underground wires in Boston, and their connection with fire risks, and also, the difficulties which have been met in our relations with the insurance companies in regard to their considering electric lights an extra hazardous risk. I stated at that time what I then believed, and now know to be the truth, that a large portion of those fires resulted from a system of underground wires. This fact was proven in a paper read by Col. Hewins at the last meeting of the New England Electric Exchange. It was also fully proved and admitted by the insurance people at a meeting of the representatives of the Boston Board of Fire Underwriters, and representatives of the electric light interest in Boston. I also know several prominent electric light men who state that the inspectors of the Boston Board of Fire Underwriters had reported to them verbally at different times that the late increase of fires from electric lighting came largely from the underground system. At the meeting above referred to of the New England Electric Exchange, a number of those fires were discussed, and from the best information obtained, they resulted directly or indirectly from the underground system. I refer to these matters because, on the third day of the convention, a gentleman representing the insurance interest of Boston, stated in a speech before the convention that what had been said the previous day in regard to fires from electric light appliances originating from the underground circuit, was not true; that such was not the fact. Therefore, as I look upon it, I to-day stand impeached before that association either as not being well informed as to the state of affairs, or that I stated a deliberate falsehood, and as I do not care to remain quietly under either of the accusations—being ready at any time to prove my assertion— I will thank you to insert this in your columns, thinking that following so closely on your report of the electric light convention, it will reach many of the same readers. I will further add that I hold myself in readiness to meet the accusation above referred to publicly, and I will take measures to bring the same before the National Electric Light Association at its next convention. Frank Ridlon.

Boston, March 15, 1889.

New Electric Light Station.

East Greenwich, R. I., now has an admirable plant of 700 sixteen candle power lamps and 98 arc lights. The three churches, public library, court house and many private houses, are illuminated with the incandescent light. The East Greenwich Electric Light and Coal Company, of which Mr. Charles O. Farnham is the energetic superintendent, is to build a new station, increasing the horse power to 300, an Armington & Sims engine being used. A second 1,000 light alternating dynamo is to be installed of the Westinghouse pattern, and the lighting will be extended to the surrounding towns.

Electric Light Companies at Providence United.

Negotiations for the consolidation of the electric lighting interests of Providence, R. I., are practically concluded. The Narragansett Company will absorb the Rhode Island Company, issuing stock in payment for the plant of the smaller concern. The Narragansett Company is now building a large station. It uses Thomson-Houston arc lights and Westinghouse alternating system for incandescent service.

—— The committee on lighting Springfield, Mass., recommends that the city consider the matter of establishing its own electric light plant.

Electric Stocks in Boston.

The tendency shown by the Boston public last week towards outside and rather speculative purchases has gained strength and has been mainly directed to electric stocks. The stocks most dealt in have been the Edison Phonographic Doll, Thomson-Houston, Thomson Welding, and Westinghouse Electric. The stocks are not listed and the sales are private and have to be picked up from office to office. Westinghouse is one of the best looking of these stocks, says the Boston *Press*, and it has not had its rise and may be expected to be pushed up somewhat. It has been scarce and somewhat sought for this week, opening at 43 and closing at 45¾. The par value is 50.

Phonographic Doll stock sold at as high as $30 at private sale, we are reliably informed, and we hear of the sales at $22. It has been quite active, and though it dropped to $12 it showed more strength towards the end of the week, and closed at $15 bid and $17 asked. The par value is $10. This is a Maine company with an office of the company in Boston. The company holds the exclusive right from Thomas A. Edison for the use of the phonograph in dolls and toy figures for the United States and all foreign countries. It also owns exclusively, letters patent for phonograph dolls in the United States and foreign colonies. The prospectus estimated that 700,000 dolls can be sold at $5 each and claims that 500,000 have already been sold, 300,000 going to France alone.

Thomson-Houston electric sold as high as 425 last week.

Thomson Welding is sold at 425 at close. It has not really done much work as yet. Its par is 100. It is capitalized at $500,000.

Insurance Officials Visit Electrical Establishments.

By invitation of H. A. Royce, general manager of the Thomson Electric Welding Co., and Charles A. Coffin, vice-president of the Thomson-Houston Co., the officers and directors of the Boston Manufacturers Mutual Fire Insurance Co. visited these establishments on the afternoon of Tuesday, March 12.

The party left Boston at noon and proceeded to Malden, where a number of electric welding machines are in operation in the electric light station, and afforded an excellent opportunity of witnessing the practical working of the apparatus in butt welding, both bars and tubes, and also examining a large number of specimens welded by this method.

After partaking of lunch, which was served in the station, they proceeded to Lynn, and first proceeded to the new works of the Thomson Electrical Welding Co., and examined the methods of constructing the electric welding apparatus.

Later in the afternoon, the party was conducted over as much of the Thomson-Houston Electric Co.'s works as the two hours at their disposal would afford.

The methods of constructing motors, dynamos, and especially incandescent lamps, afforded great interest.

The party returned to Boston at about six o'clock, and expressed themselves as fully repaid by a long and somewhat wearisome tramp, and under obligations to their hosts for the hospitality offered them by vice-president Coffin of the electric light, and manager Royce of the welding company.

A Card from the President of the Julien Company.

To the Editor of Electrical Review:

The United States Circuit Court for the Southern District of New York has just rendered a decision in the case of the Electrical Accumulator Company *vs.* the Julien Electric Company for infringement of storage battery patents.

The Electrical Accumulator Company sued the defendants on four patents. One patent the complainant abandoned during the trial; two others are decided to be invalid; two claims only of the fourth patent were in controversy. One of these claims, it was held, the defendant does not infringe; the other claim the court holds, is too broad in its present form and can be sustained only when limited by a disclaimer to a device which the defendant does not use.

The decision is a substantial victory for the Julien Electric Company.

Wm. Bracken, Prest.

New York, March 18, 1889.

General Electrical News.

Mr. George H. Hemington, of Wichita, Kansas, has invented a process for duplicating phonograms.

Mr. Henry T. Paiste, of Philadelphia, has received his patent on the very popular electric switch invented by him.

The California Electrical Society, San Francisco, has now attained a membership of 120 and is constantly growing. Its officers are: President, N. T. Keith; vice-president, Orion Brooks; secretary, William W. Wright; treasurer, C. S. Ryland.

The St. Louis Exposition this fall promises to be a very interesting and extensive exhibit. This city possesses great local pride as well as wealth and will see that the Exposition is a well-rounded success.

Capitalists in Zurich and Basle intend utilizing the falls of the Rhine for electrical purposes.

The authorities of Cork, Ireland, are making preparations to have that city lighted by electricity.

In Vienna a new process for the manufacture of copper coated steel wire for electric purposes has been introduced.

Professor Eaton, of Yale, advocates the storage battery system for street railways as being much safer for the public.

M. de Freycinet is preparing a project for the definite unification of optic, electric, acoustic signals, which will be put into operation as soon as possible.

The Burlington, Vt., Electric Light Plant.

Electric lights were first introduced in Burlington at the time of the winter carnival in February, 1886. A number of representative business men had formed a company known as the Brush-Swan Electric Light and Power Company, and had put in a dynamo capable of furnishing 1,200 candle power lights. The experiment, for such it was at the time, was satisfactory. The company started active business in July of the same year, running three dynamos by water power in the mill at the Burlington end of the Winooski bridge. A fourth dynamo soon became a necessity, owing to the rapidly increasing business. The company suffered so many inconveniences in the way of high and low water and from the other troubles which almost invariably accompany the use of water power, that the directors decided that the patrons would be better served by substituting certain steam for uncertain water power.

A substantial brick building, 35x50 feet, was built for the plant. Starting with one 140 horse power boiler and two 60 horse power engines, running four dynamos, the company soon found it necessary to duplicate both boiler and engines, while the number of dynamos has been increased from time to time, until the company now has eight machines. The two boilers are set with the Jarvis setting. The furnaces burn a mixture of soft coal and wet coal dust, giving a regular gas flame, and, with the air ducts in the side walls which feed heated air over the fire boxes, insuring perfect combustion. The room above contains the engines and dynamos. This part of the plant consists of four Armington & Sims 60 horse power engines, seven standard Brush dynamos for the arc lights, with a capacity of 210 lights of 3,200 candle power each, and a Westinghouse alternating current dynamo with a capacity of 500 incandescent lights. The engines run at a speed of 280 revolutions per minute, the arc dynamos 950, and the incandescent dynamo 2,000; the well known Schieren belts are used on all the machines. A complete switchboard, containing all the switches, lightning arresters, rheostat, voltmeters, ammeters, compensators and the other necessary appliances, takes up a portion of one side of the room back of the incandescent dynamo. For the arc light circuits, plug switches are used, so that any dynamo can be run on any circuit. The building is supplied with a two inch water pipe for fire service, with hose on each floor, and is, in short, a complete electric light station.

The company is now running 162 arc lights of 2,000 candle power on four circuits.

Electric Railways at Wilkesbarre, Pa., Steubenville, O., and Asheville, N. C.

In Fig. 1, which represents two electric cars on a Y on the Wilkesbarre and Suburban R. R., a very good idea of the Sprague method of overhead wiring in these cases can be obtained. This road is one of the earliest which was installed by the Sprague Company, and it has been in operation for about 10 months. The first installment of cars was three, for operation over two miles of track, but the success of the road has been so great that the railway company has ordered a duplicate equipment.

The illustration in Fig. 2 is from a photograph representing one of the Sprague electric cars in operation at Steubenville, Ohio, passing under a railroad bridge on the route of the road. The picture gives a very good idea of the wide range of movement of the trolley arm, which can reach from 12 to 14 feet above the car to less than one foot when the location of overhead wire demands such a wide change. The kind of trolley pole used upon this road is extremely light and unobtrusive, consisting of simply a light, hollow iron rod carried on top of the car and supported from the car by a stout steel spring, which allows it to move in every direction necessary.

The equipment of this road includes the regular Sprague system of overhead wiring, with main and working conductor running parallel, connected at intervals of every 100 to 200 feet.

The road has been a success from the start, and has carried a large number of passengers. It has been visited by a great many street railway managers from Ohio, Indiana, Kentucky, and western Pennsylvania, who have visited Steubenville for the purpose of inspecting the operation of the road, and who have expressed themselves as very well pleased with the operation of the electric system.

We give in this issue also a view taken from a photo of the Asheville, North Carolina, electric railway. Asheville is a flourishing mountain town, and it is characteristic of such a town and its enterprise that it now has an electric railway which gives the people comfortable means of transit to the depots and hotels, and replaces the old springless hacks and primitive omnibuses.

The picture shown is from a photo taken shortly after the opening of the road, and represents the electric cars turning a corner into the main street of Asheville, N. C., and it is an interesting feature to notice that it is difficult to discern the overhead system at all, on account of the smallness of the overhead wires. Besides an equipment of passenger street cars, this electric railway also possesses several freight cars also operated by electric motors of the Sprague type, and as this road connects the depot of the N. C. Railroad with the city of Asheville, these freight cars have proved a great convenience and a source of considerable income to the managers of the road.

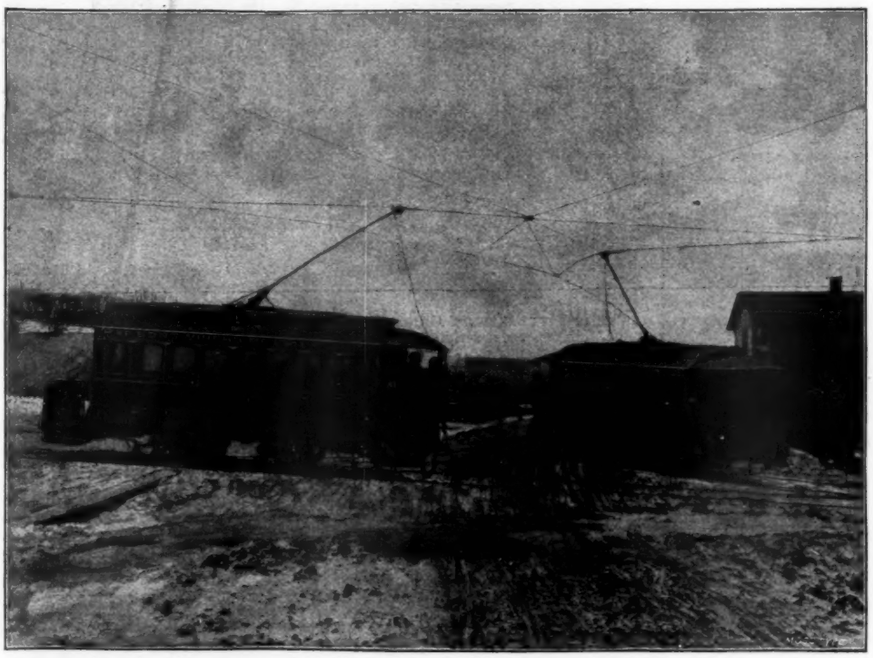


FIG. 1.—VIEW OF THE ELECTRIC ROAD AT WILKESBARRE, PA. (See next page.)

—The annual meeting of the stockholders of the Hartford Electric Light Company was held recently, and the following directors elected for the ensuing year, viz: A. C. Dunham, W. H. Bulkeley, T. O. Enders, W. O. Burr, W. H. Goodrich, Leverett Brainard, Henry Roberts, Atwood Collins, E. B. Bennett. At a subsequent meeting of the directors, A. C. Dunham was re-elected president, and H. M. Clark secretary and treasurer. The company have in operation 670 arc lights, which includes those furnished for street lighting, and 3,000 incandescent lights. The capital of the company is $200,000. The works of the company are taxed to their full capacity, and prompt measures will be taken at once to increase the capacity of the company's works and an effort made to supply the wants of the public for incandescent lights. A semi-annual dividend of three per cent. was declared, payable on demand.

—— Mr. George W. Silsby, of the Edison United Manufacturing Company, has just closed a contract for a central station at Egg Harbor City, N. J. The capacity of the plant is 600 sixteen candle power lamps.

—— The Allegheny County Light Company, Pittsburgh, has ordered the following reductions in prices: From March to September, 35 instead of 50 cents a month; from September till March, 45 to 65 cents. The reduction is the result of the enlargement of the company's plants.

—— Chattanooga, Tenn., has one of the finest electric light stations in the South. The new station now being completed is being equipped throughout in finest style, and will have a capacity for 250 arc lights. The boiler capacity is 500 up. There are now 110 arc lights in use in the city, and the authorities are negotiating to erect 50 more at the central points over the city, the only obstacle now in the way being the fear that it will conflict with the gas contract. This matter is now being investigated, and if it can be lawfully done, the electric lights will probably be ordered. It is understood that they have been offered at $12.50 each per month. The arc lights are giving a brilliant, steady light, and are the subject of much favorable comment.

—— The electric light plant at Tuscumbia, Ala., is to be in operation in 60 days from the time it was commenced. The building, which is 28x38 feet, is now nearly completed. The machinery, a part of which has been received, is furnished by the Thomson-Houston Electric Light Company.

—— The Consolidated Electric Light Company of Kansas City, Kan., has decided to put in an incandescent system, and the contract for the new appliances has been given to the Westinghouse Company of Pittsburgh. The Consolidated Company has been using only the arc lights since it began about six weeks ago.

—— Application for a patent for an electric light method of instant photography has been made by two gentlemen of Dubuque, Iowa. The application is designed especially for the detection of burglars. The apparatus can be so arranged that a burglar in entering a bank, office or dwelling will in his operations touch something that will cause a flash and the result will be his photograph left indelibly on the plate. A number of cameras may be placed in the room and a variety of views taken simultaneously. The tell-tale wire can be fastened to the knob of the safe or door, so that he can not avoid touching it, thus disclosing his identity.

——A new electric light company, known as the Missouri Electric Light and Power Company, has entered the field at St. Louis, Mo., and will compete with the united companies of that city. The Westinghouse system is used by the new company.

—— It is stated that a project is afloat to run an electric road sweeper for London streets. This will be driven by accumulators, which also drive the revolving brush. No horses will be required, and one man will be enough to drive it.

—— The electric light station at Portland, Me., has been thoroughly renovated; 16 new dynamos from the Thomson-Houston Co. have been received and four more are expected. New lamps are being put in throughout. A new 90-horse power Armington & Sims engine has just been received. There are 20 dynamos in this station and ten engines, of which seven are 50-horse power, one of 65, and two of 90-horse power. They have a capacity of 3,000 incandescent and 400 arc lights. One dynamo is used during the day to furnish power for motors throughout the city. By an ingenious contrivance of switches any dynamo can be cut off without affecting the lighting of the city, the extra power being shared by the other dynamos.

—— The Concord Gas Light Company has bought out the Concord Electric Light Company, and will run it in the future. The plant consists of 126 arc lights.

—— The Dedham Electric Light Company, of which John R. Bullard is president, is erecting a building on the Sheriff estate, near the Old Colony railway station, where they propose to generate electricity, and to show the citizens what kind of a light they can furnish.

—— The plant of the Joplin Electric Light Company, O. R. Moffet principal stockholder and general manager, was burned recently. The fire caught in the roof, origin unknown. The actual loss is not known, as it is not certain to what extent the dynamos are damaged. The cost of the building, machinery and fixtures was $10,000, insured for $2,000.

—— The electric light controversy in Lockport, N. Y., has been practically settled by the Common Council taking a two years' contract with the gas company for lighting the streets at the following figures: For each gas lamp, $15 a year; for each incandescent electric light, 20-candle power, $14 a year; for each arc electric light, 2,000-candle power, $80 a year.

ELECTRIC LIGHT NEWS

—— The citizens of Durham, N. C., are petitioning for additional electric lights.

—— The South Pittsburgh Electric Light and Power Company have contracted for 35-arc Jenney electric plant.

—— The Edison lights in the streets of Birmingham, Ala., are being extended. The railroad crossings are being thoroughly well lighted.

—— The Hickory (N. C.) Electric Light Company has been incorporated to run the plant purchased from the Brush Electric Company.

—— The legislative committees of reference, Nashville, Tenn., have decided to recommend the passage of the bill giving a franchise to the Capital Electric Company, reported as organized by the Thomson-Houston Company, to build electric light works.

—— The city council of Thomasville, Ga., has granted electric light franchise, for lighting the streets, to J. W. Reid and others, of Thomasville.

—— The Gas Light Company of Rome, Ga., reported as purchasing electric light plant, have received contract to light the city with electricity.

—— The Philadelphia *Call* says that interest in electric conduits in that city has about "petered out." Has the conduit met with the same success?

—— The Fall River Electric Light Co. have elected the following officers: President, M. J. Perry, of Providence; clerk and treasurer, F. O. Dodge. Directors, M. J. Perry, F. S. Stevens, J. D. Flint, W. H. Hathaway, F. O. Dodge, E. L. Anthony and W. B. Hosmer, of Boston.

—— Councils' Electrical Committee of Philadelphia has granted permission to the Merchants' Electric Light Company to open streets and lay and maintain underground conduits and wires for lighting by electricity the northeastern section of the city. Similar action was taken on a bill extending lines of the American Telephone and Telegraph Company in the Twenty-fourth ward, at a cost of $3,000.

—— The city council of Americus, Ga., are considering a proposition from the New York Contract Co., of New York, to light the streets by electricity.

—— The Belton Light and Water Company, of Belton, Texas, have become the proprietors of that system for Texas, and have several plants projected.

—— Mr. James Chambers on 8th of March closed contract with Fernandina Light and Power Co., Fernandina, Fla., for 50 light arc plant, and 50 horse-power steam plant, will commence to construct at once. Thomson-Houston electric lighting system will be used.

—— Proctor's new theatre on 23d street, just to the west of Sixth avenue, has contracted with the Manhattan Electric Light Co. to be lighted by electricity, the Slattery induction system being used. This is the first theatre in New York to be lighted by the alternating current.

MANUFACTURING NOTES.

The Empire City Electric Company.—This company is meeting with almost phenomenal success, the result of energetic and modern business methods. There is no better arranged electrical business house in New York than that of the Empire at 15 Dey street, and some of the older establishments will have to brace up or be distanced by this enterprising concern.

The Tesla Motor.—This motor is adapted to run sewing machines, the current being alternating. In a recent test the motor of one quarter-horse power was attached to an ordinary incandescent lamp socket. Another appliance, which is arranged so as to be moved by the treadle of the machine, is the regulator. A slight touch of the treadle either makes the machine run fast or slow, just as it is required. This is the first time that the alternating current has been used to run a sewing machine.

Electrical Contract Work.—Messrs. H. E. and C. Baxter, of 18 Fulton street, Brooklyn, New York, make a specialty of contracting for electrical work from drawings or from original models. Their large establishment on Fulton street, just above the ferry, is fitted up with a special view for such work. This is a branch of electrical manufacture where a great deal depends on the expert ability of the manufacturers, and the success that the Baxter gentlemen have made of it in the past is excellent proof of what may be expected at their hands in the future.

Tobin Bronze.—The Ansonia Brass and Copper Co., of New York and Chicago, are the sole manufacturers of this bronze, which is attracting attention in electrical circles. In a recent neat little pamphlet are published a number of very strong endorsements of this bronze from electrical manufacturers, who state they have found it superior for castings, forgings and sheets, and possessing strength, toughness and uniformity of texture. It is reported to be particularly adapted for brushes for dynamos, and in this respect is enjoying the attention of the builders of such machines. At a dead red heat Tobin bronze can be forged and stamped as readily as steel. Bolts and nuts can be forged from it, either by hand or by machinery, with a marked degree of economy. It works well in the lathe, and when finished has a bright golden color, making it especially adapted for machine screw bolts, and a variety of parts of electrical machines, nautical instruments, etc. Its freedom from blow-holes, compactness, durability and anti-frictional properties, make it especially adapted to resist the wear and abrasion of valves and valve faces, shaft bearings for railway cars, rolling mills, dynamos, and heavy machinery of all kinds. When rolled into sheets and tempered it makes a most excellent spring metal for electrical apparatus.

New Haven Clock Company.—This long established company was welcomed into the electrical field about two years ago, and now has a fine trade in a number of electrical novelties. Mr. J. G. Noyes has quietly and ably developed the electrical business of this widely known company, until it has become a leading part of its business.

Electrical Supply Company.—The Electrical Supply Company have gone into the manufacture of composition wire, especially adapted for the manufacture of fuses. Mr. Terry, Chicago manager of the company, says they propose to reduce the matter of fuse wire to a better system than ever before, and be in a position to fill large orders.

The Chicago Rawhide Manufacturing Company.—This company, realizing the great field that electric lighting is opening up, is manufacturing special rawhide belting for dynamos. The belt is very durable, strong and economical, and is said to possess a grip that would cast John L. Sullivan in the shade. The rawhide rope for round belting transmission is said to possess such manifest excellence that this company has largely captured the field.

Electrical Accumulator Company.—The Detroit office of this company has removed to Power Station, 30 Atwater street, east, ground floor, where all future business will be transacted. The business of furnishing incandescent electric light service, the sale of electrical accumulators and electric light plants will be continued as heretofore. Mr. G. E. Fisher is the wide-awake manager.

Okonite.—Okonite wire is in great demand for all first class work. There is a brisk call for it from all parts of the country. The Standard Electrical Works, Cincinnati, representatives of the Okonite Company, have just closed, against strong competition, a large contract to furnish the Cincinnati Railway Company with Candee aerial wire for their main lines. Tha new Chamber of Commerce building, Cincinnati, has also recently been entirely installed with Okonite wire through the efforts of the Standard Company. They are well known in electrical circles, and handle only the best goods in all their various lines of trade.

Fort Wayne Jenney Electric Light Company.—Mr. R. T. McDonald, manager of the Fort Wayne Jenney Electric Light Company, with headquarters at 115 Broadway, New York, is one of the busiest men in the electric light industry. Since coming East and establishing headquarters his company has secured a very large business, and through the Manhattan Electric Light Company of this city is kept busy supplying light to the New Yorkers. After the first of May additional room for his headquarters at 115 Broadway are contracted for, the increase of business requiring this.

The "K. K." Wire.—The patent "K. K." line wire manufactured by Holmes, Booth & Haydens, is very much in demand by electric light companies and by companies building electric rail ways, and is reported to be giving excellent satisfaction wherever used. At the office of Mr. Thos. L. Scovill, the New York agent of this company, a piece of a branch has been received, taken from a tree at Red Bank, N. J., in which the bark was all rubbed off one side, and part of the wood itself worn away. This piece of wood had been sent in by Mr. D. H. Applegate, of the Red Bank Electrical Illuminating Company, who said the wear on the wire was barely perceptible, and that he had noticed several places where limbs had been cut into by the wire, the insulation remaining intact. Mr. Scovill is very naturally proud of this illustration of the excellent quality of "K. & K." insulation.

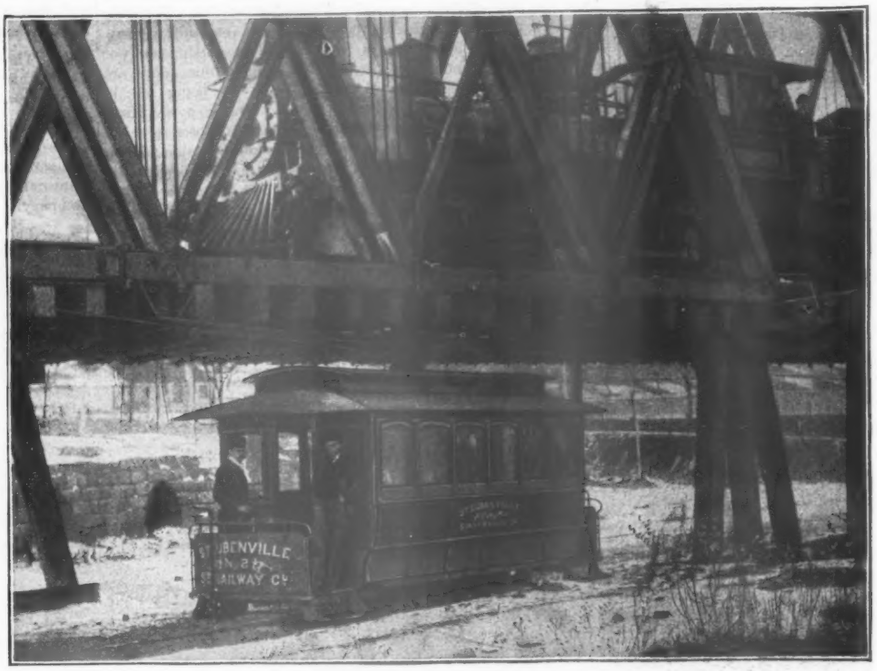


FIG. 2.—ELECTRIC RAILWAY AT STEUBENVILLE, OHIO.—CARS PASSING UNDER RAILROAD BRIDGE.
See description on page 9.

FIG. 3.—VIEW OF ELECTRIC ROAD AT ASHEVILLE, N. C.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MARCH 12, 1889.

399,155 Electrical railway signaling apparatus; Henry J. Palmer, Brooklyn, N. Y.

399,163 Electric signal for engine shafts; James C. Ricketson, Milwaukee, Wis.

399,168 Electric cigar lighting device; William Tag and Sanford C. Smith, Philadelphia, Pa.

399,192 Mechanism for weighing package tea, coffee, etc.; Owen A. Gill, Baltimore, Md.

399,209 Electric amalgamator; Julio H. Rae, San Francisco, Cal.

399,213 Dynamo electric machine; James H. Robertson, Rutherford, N. J.

399,218 Regulator for systems of electrical distribution. 399,219 Method of regulation for systems of electrical distribution. Lewis B. Stilwell, Pittsburgh, Pa., assignor to the Westinghouse Electric Company, same place.

399,224 Electric regulator; Frank C. Wagner, Ann Arbor, Mich.

399,228 Circuit closer for railway car telegraphs; George I. Hopkins, Manchester, N. H.

399,236 Electric railways; John B. Blair, Chicago, Ill., assignor to himself and Ulric Blickensderfer, same place.

399,291 Hydraulic press for covering electrical conductors with soft metal; Werner Siemens, Berlin, Germany, assignor to Siemens & Halske, same place.

399,292 Electrical measuring and controlling apparatus; Wilhelm Siemens, Berlin, Germany, assignor to Siemens & Halske, same place.

399,320 Dynamo machine; Geo. L. Du Laney, New York, N. Y.

399,326 Coupling for electric circuits; Albert C. Griggs, Wilmington, Del.

399,328 Dynamo armature; Joel A. Hayes, San Francisco, Cal.

399,329 Commutator for dynamo electric machines and electric motors; Benjamin Heywood, New York, N. Y.

399,331 Electric railway switch and alarm; William S. Hull, Sheffield, Ala., and James C. Anderson, Charleston, N. C.

399,336 Electric meter; Edward F. H. H. Lanckert, Charlton, County of Kent, assignor to Siemens Bros. & Co., Ltd., Westminster, England.

399,341 Electrical appliance for stopping and starting elevators; Ronald F. McFeeley and Henry V. Potter, Pittsburgh, Pa.

399,342 Railway switch signal; Henry M. Norton, Louisville, Ky., assignor of one-half to Edward E. Morris, same place.

399,343 Underground electric wire conduit; William L. Penney and Thomas Little, Pittsburgh, Pa.

399,372 Electric railway system; Charles S. Bradley, Yonkers, N. Y.

399,377 Electric circuit; John J. Carty, New York, N. Y.

399,400 Electric circuit protector; Wirt B. Harvey, Memphis, Tenn.

WANTED.—An experienced Electrician, capable of taking charge of a 1,300 16 C. P. Lamp Central Station Alternating System Plant. One who understands the Westinghouse system preferred. Apply, stating experience and salary expected.
STORMONT ELECTRIC LIGHT & POWER CO., Cornwall, Ont.

SITUATION WANTED.—A Glass Blower with good references, who thoroughly understands all work on Incandescent Lamps, and also has thorough experience in making Glass Pumps and Stop Cocks. Address, O. B., care ELECTRICAL REVIEW, New York City.

FOR SALE.—Stock in Corporation is offered by Treasurer who leaves the city April 1st. Full investigation solicited.
"WARD,"
CARE OF ELECTRICAL REVIEW.

All Kinds of Electrical Wood Work.

CUT OUT BLOCKS,
SWITCH & SOCKET BLOCKS,
ROSETTES, FUSE BOXES,
BASES, WOOD CLEATS,
MOULDING, ETC., ETC.

Correspondence Solicited and Estimates Promptly Furnished.

THE JAMES H. HAWES MFG. CO.,
TOWANDA, BRADFORD CO, PA.

WANTED.

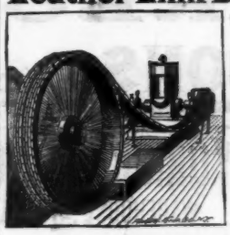
I have clients who will purchase second hand Arc and Incandescent Dynamos, Lamps, Sockets and accessories.

W. H. COLE,
Electrical Engineer,
502 West 53d St.,
New York City.

ELECTRICAL COMPANIES can make favorable arrangement for their **Legal Business** with a young Boston Attorney familiar with **Corporation** and **Patent** law. Address
"Attorney,"
Care of Electrical Review,
P. O. Box 3329, New York.

THE LEHIGH VALLEY
CREOSOTING CO.
PERTH AMBOY, N. J.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

AMERICAN
Leather Link Belt Co.



"American Patent Joint"
Leather Link Belting
Specially adapted to
DYNAMOS.

FACTORY, 46 & 48 FERRY ST., NEW YORK.
OFFICE, 72 CLIFF STREET,
NEW YORK. CHICAGO, BOSTON. PHILA.

O. K.

Full Size!!!
NO ONE
Denies this to be the only safe automatic in the
LAND
Perfected
Improvements
Commend it to the Trade.
$6.00 EACH.
Discount (—).
A. L. BOGART,
22 Union Sq., N. Y.

O. K.

WALTHAM

WATCHES
are the best for electricians, railroad men, engineers and others whose vocation requires a watch that is both absolutely non-magnetic and an accurate timekeeper.
Manufactured and Warranted by the
AMERICAN WALTHAM WATCH CO.
WALTHAM, MASS.

CONDENSERS WM. MARSHALL, MANUFACTURER. Standards a Specialty
Rooms 2 and 4, University Building, New York.

Detroit Electrical Works

MANUFACTURERS OF
ELECTRIC SUPPLIES,
INCLUDING
Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins and Brackets.
Insulated Magnet, Telephone and Electric Light Wire.
GENERAL OFFICES and FACTORY:
DETROIT, MICH.

A SIGNIFICANT FACT.

SAMSON BATTERY

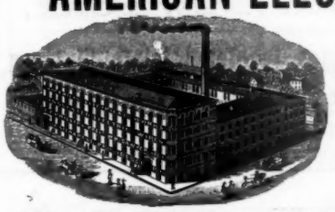
THOSE WHO TRY THE "SAMSON" BATTERY ADOPT IT FOR GENERAL USE, AND GROW MORE AND MORE ENTHUSIASTIC IN ITS PRAISE.

ITS MERITS ARE LASTING, AND LIKE ALL GOOD FRIENDS, IT WEARS WELL, AND IMPROVES ON ACQUAINTANCE.

THE BATTERY IS TO AN ELECTRICAL PLANT WHAT THE DIGESTIVE ORGANS ARE TO A MAN; THE HEALTH OF THE ENTIRE SYSTEM DEPENDS THEREON. A CHEAP BATTERY DOESN'T PAY.

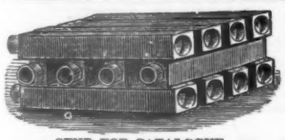
THE ELECTRIC GAS LIGHTING CO.
35 ARCH STREET, BOSTON, MASS.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.
AMERICAN ELECTRICAL WORKS



MANUFACTURERS OF
Patent Finished Insulated
ELECTRIC WIRES,
TELEPHONE AND ELECTRIC CORDAGE,
Electric Light Wire, Magnet Wire,
PATENT RUBBER COVERED WIRE OFFICE AND ANNUNCIATOR WIRE. LEAD-ENCASED WIRE, ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES, ETC., ETC.
OFFICE AND FACTORY, No. 67 STEWART ST., PROVIDENCE. R. I.
New York Office: 18 Cortlandt St., P. C. Ackerman, Agent.

Westfield Mass.
MANUFACTURERS OF
Polished and Dressed Threads
Yarns in the Grey and in all Numbers and Colors.
We make a Specialty of Threads for Covering Wires for Electrical Purposes.
Samples Sent on Application. *Correspondence Solicited.*



SEND FOR CATALOGUE.

THE WYCKOFF PIPE CO.,
MANUFACTURERS OF
WOODEN PIPES FOR
UNDERGROUND ELECTRICAL WIRES.
We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.
WILLIAMSPORT, PENN.

The First Real Improvement
—IN—
POROUS CUP BATTERIES
Since the Invention of the
LECLANCHÉ,

SEND FOR
Circulars and Price List.
The Leclanché Battery Co.
149 West 18th St., New York.

A
WONDER!

HOW WE CAN SELL
GRAVITY DROP ANNUNCIATORS
AT SUCH A LOW PRICE.
NO BUGS ON OUR DUST-PROOF BELLS.
HAZAZER & STANLEY, 32 & 34 FRANKFORT ST., NEW YORK.

D. W. Baker. Cyrus O. Baker, Jr.
BAKER & CO.,
Importers, Melters and Refiners of
PLATINUM,
408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

FARADAY CARBON CO.,

ELECTRIC LIGHT CARBONS, PITTSBURGH, PA.

Plating Machines that require a speed from 1800 to 3600 revolutions per minute are Useless Toys.

$100.00

THE

"LITTLE WONDER"

DYNAMO-ELECTRIC MACHINE.

Over 1000 in Successful Operation. Has the largest sale of any Electro-Plating Machine.

SEND FOR CATALOGUE OF 1889.

Manufactory and Offices,

Newark, N.J.

New York Office, 32 Liberty Street.

NEW YORK BELTING AND PACKING CO.

WAREHOUSE: 15 PARK ROW, NEW YORK.

The Oldest and Largest Manufacturers in the United States of

VULCANIZED RUBBER

In every form adapted to mechanical purposes.

MACHINE BELTING,

With Smooth Metallic Rubber Surface

This Company has Manufactured the Largest Belts made in the World for the principal elevators at Chicago, Buffalo and New York.

We make a Superior Quality of Belting for Electric Light purposes, for use on Dynamos and Swift running machinery.

JOHN H. CHEEVER, Treasurer.

BRANCH HOUSES AT BOSTON, PHILADELPHIA, CHICAGO, ST. LOUIS,
European Branch: Pickhuben 5, HAMBURG, (Freihafengebiet), GERMANY.

E. P. Gleason Manuf'g Co.

181-189 MERCER ST., NEW YORK.

—MANUFACTURERS OF—

Electric Light Appliances, Fittings, Insulated Joints, Fixtures,

GLOBES, SHADES, FANCY LAMPS,

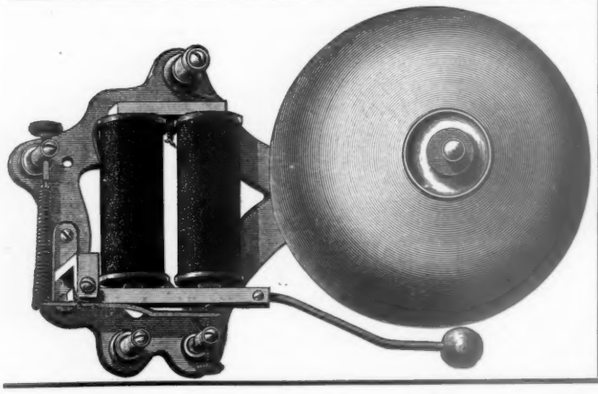
ETC., ETC., ETC.

SEND FOR CATALOGUE E. AND SUPPLEMENT.

REGISTER SPRINGS A SPECIALTY
CARY & MOEN
Manufacturers OF ALL KINDS OF
234 West 29 St. FOR ELECTRICAL INSTRUMENTS
SPRINGS

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.
THE OLD RELIABLE
—LEFFEL—
WATER WHEEL
SEND FOR CATALOGUE.
JAMES LEFFEL & CO.
SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

Manufacturers



H. E. & C. BAXTER,
18 Fulton Street, Brooklyn, E. D.

THE ELECTRIC CURRENT

A MONTHLY JOURNAL

Devoted to the interests of Electrical Science, being a record of progress in Electricity and its practical applications to the various industries covering the Telegraph, the Telephone, the Electric Light, Electrical Transmission of Power, Etc.

THE LARGEST CIRCULATION OF ANY ELECTRICAL PAPER PUBLISHED

Subscription Price, Postage Prepaid One Year $1.00

CORRESPONDENTS WANTED.

SAMPLE COPY FREE.

THE ELECTRIC CURRENT CO.
No. 7 Mozart Building,
LOUISVILLE, KY.

BROWNLEE & CO.,
DETROIT, MICH.
DEALERS IN
CEDAR TELEGRAPH POLES.
MANUFACTURERS OF
Cross Arms, Pins and Brackets, Oak and Locust Pins, CEDAR TIES, For Electric Railways.

VITALIS HIMMER, Manager.

DR. GASSNER'S DRY BATTERY

GREAT AND MERITED SUCCESS.

ADVANTAGES OVER WET BATTERIES:

Longer Length of Life. No Glass, consequently no Breakage. Easier and more Convenient to Handle. High or Low Temperature does not affect them. Invaluable for Telephone, Telegraph, Physicians, Railroads and Steamboats.

HIGHEST TESTIMONIALS.

— FOR SALE AT —

The Western Electric Co., Chicago, Ill.
and California Electrical Works, San Francisco, Cal.

WRITE FOR CIRCULAR.

A. SCHOVERLING,
111 CHAMBERS STREET, N. Y.

THE NATIONAL CARBON CO.

CLEVELAND, OHIO.

MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

IS THE

INCANDESCENT LAMP

AN

EDISON MONOPOLY?

One Dozen Selected Extracts from Documents in the Case.

I.

Extract from a widely circulated and well-known publication, entitled **A Warning from the Edison Electric Light Company,** commonly called the "Red Book."

Mr. Edison's fundamental lamp patent, No. 223,898, was applied for November 4, 1879, and issued January 27, 1880. The claims are as follows:

1. **An electric lamp** for giving light by incandescence, consisting of a **filament of carbon** of high resistance made as described, and secured to **metallic wires,** as set forth.

2. The combination of **carbon filaments,** with a **receiver** made entirely of glass, and **conductors** passing through the glass, and from which receiver the **air is exhausted,** for the purpose set forth [page 33].

II.

Extract from card of **Edward H. Johnson,** President of the **Edison Electric Light Company,** May 24, 1885.

Edison's patent of January 27, 1880, applied for at the time of his **great discovery, covers broadly all the elements of that discovery,** and is, therefore, **fundamental and controlling** [page 5].

III.

Extract from **A Warning from the Edison Electric Light Company.**

It is **impossible to construct any lamp** of commercial utility **without employing Edison's filament of carbon** [page 6].

IV.

Extract from **A Warning from the Edison Electric Light Company.**

The lamp covered by the above-mentioned patent is the **key** to the **entire industry** of incandescent electric lighting [page 9].

V.

Extract from **Revised Statutes of the United States** [Section 4887].

Every patent granted for an invention which has been previously patented in a foreign country **shall be so limited as to expire at the same time with the foreign patent,** or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force for more than seventeen years.

VI.

Extracts from **Opinion** of the **United States Supreme Court** in the **Bate Refrigerator Case,** January 21, 1889.

These provisions of the Act of 1870, and of the Revised Statutes, mean that the United States patent shall not expire so long as the foreign patent continues to exist, not extending beyond seventeen years from the date of the United States patent, but shall continue in force, though not longer than seventeen years from its date, so long as the foreign patent continues to exist. * * * * * **It is to be in force as long as the foreign patent is in force.** * * * A contrary view to this has been expressed by several Circuit Courts of the United States. * * * * The time of the expiration of the foreign patent may be shown by evidence *in pais*, whether the record of the foreign patent itself, showing its duration, or other proper evidence.

VII.

Extract from Advertisement signed by **Edward H. Johnson,** President of the **Edison Electric Light Company,** in ELECTRICAL REVIEW, February 2, 1889.

The Edison Electric Light Company takes pleasure in announcing to its patrons and the general public, that the decision of the Supreme Court of the United States, filed on the 21 inst., in the case of the **Bate Refrigerator Company,** is in fact **a decision sustaining the Edison patents.**

VIII.

Extract from **Revised Statutes of Canada** [Cap. 61, Sec. 37].

Every patent granted under this Act, shall be subject and be expressed to be subject to the condition that **such patent** and all the rights and privileges thereby granted **shall cease and determine,** and that the patent shall be **null and void** at the end of **two years** from the date thereof, unless the patentee or his legal representatives, within that period, commence, and, after such commencement, continuously **carry on in Canada, the construction or manufacture of the invention** patented, in such manner that any person desiring to use it may obtain it, or cause it to be made for him, at a reasonable price, at some manufactory or establishment for making or constructing it in Canada, and that **such patent shall be void** if, after the expiration of **twelve months** from the granting thereof, the patentee or his legal representatives or his assignee for the whole or part of his interest in the patent **imports or causes to be imported into Canada,** the invention for which the patent is granted; and if any dispute arises as to whether a patent has or has not become null and void under the provisions of this section, such dispute shall be decided by the **Minister or the Deputy of the Minister of Agriculture,** whose decision in the matter **shall be final.**

IX.

Extract from claims of Canadian patent of **Thomas Alva Edison,** No. 10,654, November 17, 1879.

First. An electric lamp for giving light by incandescence, consisting of a **filament of carbon** of high resistance made as described, and secured to **metallic wires** as set forth.

Second. The combination of **carbon filaments** within a **receiver** made entirely of glass through which the **leading wires** pass, and from which receiver the **air is exhausted** for the purpose set forth [compare 1. ante].

X.

Extracts from Decisions of **Deputy-Minister of Agriculture,** of Canada, Ottawa, February 26, 1889.

I, therefore, hold, that the **Minister of Agriculture,** or his Deputy, has **exclusive jurisdiction** as to the question of the **validity of the patent** under the 37th section of **The Patent Act,** and cannot divest himself of it by relegating it to any other tribunal whatever. * * * * * * * *

It is manifestly clear that the **essential feature** or element **of the invention,** as particularly described in the first and second claims is **a carbon filament of high resistance;** this is the novelty which the inventor has contributed to the art of incandescent lighting, and it cannot be disputed by any one having the slightest acquaintance with patent law, that the carbon filament, as imported by the patentee and his representatives, the respondents, and which they still continue to import, is claimed in and covered by the patent; or that any one who should use it, without the permission or consent of the respondents, would render himself liable to them in an action for infringement of the patent. * * * * * * * * * *

I find that **every essential feature, element, and component part of the invention** was, and still continues to be, **imported into Canada** by the respondents, **in a manufactured state,** for the especial purpose of assembling or putting them together, so as to make an **incandescent electric lamp,** such as that **described and claimed in the patent** held by them and now in dispute. * * * * * * * * * * * *

I therefore hold, that the patentee and his representatives have **imported into Canada,** since the 17th day of November, 1880, **and still continue to import,** the various elements and parts comprising **the invention claimed in the patent No. 10,654,** in a **manufactured state;** and that they have **not at any time** since the date thereof, **manufactured the invention in Canada.** * * * * * * * *

I accordingly decide that the **Patent** granted to **THOMAS ALVA EDISON,** on the 17th of November, 1879, under the number 10,654 for **the Edison Electric Lamp** has become **null and void,** under the Provisions of the 37th section of **The Patent Act.** [For effect of this decision, compare V. and VI. ante.]

XI.

Extract from interview with **Edward H. Johnson,** President of the **Edison Electric Light Company,** reported in New York *Evening Post,* March 9th, 1889, in which Mr. Johnson said:

We expected a decision, but not **this** one.

XII.

Extract from the New York *Electrical Engineer,* March, 1889.

Under the decision of the United States Supreme Court recently given in the Bate Refrigerator case, **Edison's fundamental lamp patent** in the United States, No. 223,898, would seem to be **dead beyond hope of resurrection.**

The Empire City Electric Co.

15 Dey Street, NEW YORK.

OUR

New Catalogue

128 PAGES.

CONTAINING EVERYTHING

— IN THE —

ELECTRICAL LINE.

Mailed to any one in the Trade on Application.

THE E. S. GREELEY & CO.,

Nos. 5 & 7 Dey St., New York

Manufacturers and Importers of and Dealers in

Telegraph, Telephone

— AND —

Electric Light Supplies

AGENTS FOR

Cleveland Arc Light Cut Outs & Gang Switches

Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.

Rubber, Porcelain and Glass Insulators

WIRES OF ALL KINDS.

Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.

Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

Washburn & Moen Mfg. Co.

WORCESTER, MASS.

MAKERS OF

IRON AND STEEL

MANUFACTURERS OF

Iron and Copper Wire for Electrical Purposes.

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

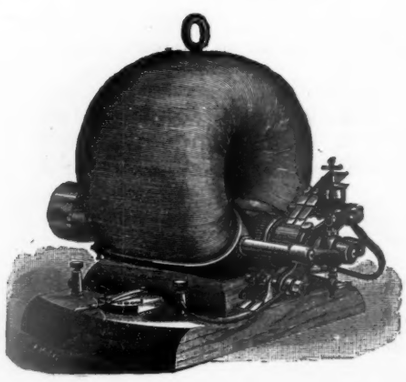
Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse. 16 CLIFF STREET.

Chicago Warehouse, 107 & 109 LAKE ST.

THE EDDY ELECTRIC M'F'G CO.

MANUFACTURERS OF



AUTOMATIC ELECTRIC MOTORS,

In all sizes, from 1-2 H. P. upward; High Efficiency; Perfect Regulation; Superior Workmanship; Ease of Management; Remarkable Simplicity, etc., etc.

DYNAMO ELECTRIC MACHINES,

For Electro-Plating, Electrotyping, Copper Refining, Etc. No Reversing. No Water. No Noise. No Spark.

SATISFACTION GUARANTEED.

THE EDDY ELECTRIC M'F'G CO., WINDSOR, CONN.

NEW YORK, 115 Broadway, BOSTON, 620 Atlantic Ave., PHILADELPHIA, 506 Commerce Street.

EDISON TRIUMPHANT.

HIS PATENTS SUSTAINED

BY THE

United States Supreme Court.

THE

EDISON ELECTRIC LIGHT CO.

Takes pleasure in announcing to its patrons and the general public that the decision of the Supreme Court of the United States, filed on the 21st inst., in the case of the Bate Refrigerator Company, is in fact a decision

SUSTAINING THE EDISON PATENTS.

In the many suits brought by the Edison Company, in the lower courts, against infringers of the Edison Patents, the defendants have evaded the MERITS of the controversy, thus tacitly admitting the fact of infringement, and have interposed a plea alleging that our Patents have been voided by the expiration of Patents previously granted in foreign countries.

Hence the delay in establishing our rights. In the meantime other electrical companies have been indiscriminately copying our devices and methods, not even assuming that they themselves were the original inventors, but simply relying upon the construction of a statute by the lower courts invalidating our fundamental Patent. In pursuance of our expressed determination to secure a decision upon the point of law involved, we have had the Bate Refrigerator case (covering the identical question) argued before the United States Supreme Court, with the result announced above, thus

Completely depriving the Defendants of their Main Defense.

We have now only to prove the fact of infringement in order to secure prompt injunctions against and damages from those who have been so long using with impunity that which the HIGHEST AUTHORITY now concedes to have been ours, exclusively, from the beginning. This is simply to establish

A QUESTION OF FACT.

WAS, OR WAS NOT EDISON THE ORIGINAL INVENTOR?

This question has been decided in his favor a great many times, primarily by the United States Patent Office, which granted to him Patents bearing earliest dates; then by the various courts of Europe, through the crucial examination of which the question has MANY TIMES passed.

Thus the QUESTION OF LAW having now been settled by the United States, and the QUESTION OF FACT by the highest experts of the world, this Company now notifies the public of its intention to call a halt and demand a reckoning for the trespass and abuse of its rights in

INCANDESCENT ELECTRIC LIGHTING.

EDISON ELECTRIC LIGHT CO.,

16 & 18 Broad Street, New York. By EDWARD H. JOHNSON, President.

THE

WESTINGHOUSE ELECTRIC CO.

PITTSBURGH, PA.

The Pioneers of Incandescent Lighting

BY

Alternating Currents

AND OWNERS OF

FUNDAMENTAL PATENTS PERTAINING THERETO.

COMPLETE CENTRAL STATION OUTFITS

Alternating Current Apparatus,

Direct Current Apparatus,

Arc Lighting Apparatus,

Electric Motors,

Electric Meters.

150 Central Stations in Operation 150

OFFICES IN ALL LEADING CITIES.

THE

WESTINGHOUSE

ELECTRIC CO.,

PITTSBURGH, PA.

— LESSEES OF —

The United States Electric Lighting Co.

SALES DEPARTMENT, 120 BROADWAY, NEW YORK.

ARC AND INCANDESCENT APPARATUS

— FOR —

ISOLATED LIGHTING

EFFICIENT APPARATUS.
ECONOMICAL LAMPS.
INGENIOUS DEVICES.

THE

Sawyer-Man Electric Co.

510 West 23d Street, New York.

Incandescent Electric Lamps,

— AND —

SUPPLIES FOR ELECTRIC WORK.

Electric AND Combination Fixtures.

CORRESPONDENCE WITH DEALERS INVITED.

P. and B. FOR WEATHERPROOF QUALITIES. UNEQUALLED

P. AND B.

BEST AND CHEAPEST

WEATHERPROOF LINE WIRE.

POLES. CROSS ARMS, PINS, BRACKETS. INSULATORS, ETC. TOOLS.

☞ WRITE FOR SAMPLES AND QUOTATIONS. ☜

THE ELECTRICAL SUPPLY COMPANY,

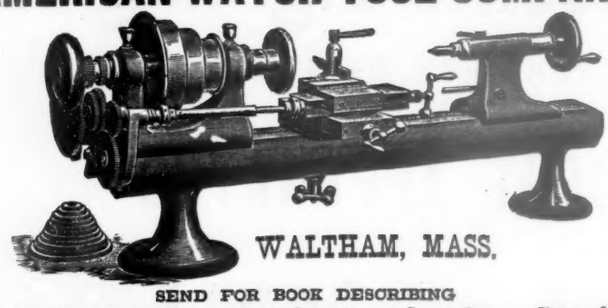
ANSONIA. Factories and Eastern Office, ANSONIA, CONN.

CHICAGO. Warehouse and Western Office, 171 Randolph St., CHICAGO.

BRANCH OFFICE. 505 Delaware Street, KANSAS CITY.

EASTERN SELLING AGENTS, T. F. HUNTER & CO., 37 CHURCH STREET, NEW YORK.

AMERICAN WATCH TOOL COMPANY



WALTHAM, MASS.

SEND FOR BOOK DESCRIBING

Grinding, Screw Cutting, and other Special Fine Tool Making Accessories.

JARVIS ENGINEERING COMPANY,

CONTRACTING ENGINEERS for ERECTING COMPLETE STEAM PLANTS

For Electric Lighting and Power Stations.

—: AGENTS FOR :—

ARMINGTON & SIMS ENGINES,
JARVIS BOILER SETTING,
to burn Anthracite Coal and Coke Screenings,
NATIONAL FEED WATER HEATER,
NATIONAL ROCKING and
SHEFFIELD GRATE BARS.

61 OLIVER ST., BOSTON. 109 LIBERTY ST., NEW YORK. 81 LAKE ST., CHICAGO.

SEND FOR NEW CATALOGUE.

POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, KANSAS CITY AND OMAHA.

W. R. OSTRANDER & CO.
21, 23 & 25 ANN ST., NEW YORK.
Manufacturers of
SPEAKING TUBES, WHISTLES
ANNUNCIATORS,
Electric & Mechanical Bells

FACTORY,
De Kalb Avenue,
BROOKLYN.
Send for Illustrated Catalogue.

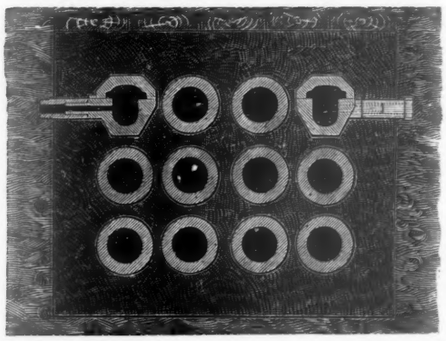
Sperry Electric Company,

Factory, 194 to 198 So. Clinton St., Chicago, Ill.

MANUFACTURERS OF THE

Improved Sperry High and Low Tension Systems of Arc Lighting,

Claiming the Highest Efficiency, Reliability and Durability. Perfect Regulation.



C. H. JACKSON, Prest. EDWARD S. PEROT, Vice-Prest. JAS. P. MCQUAIDE, Sec'y and Treas.

THE NATIONAL CONDUIT M'F'G COMPANY'S

WROUGHT IRON CEMENT-LINED PIPE.

FOR ELECTRICAL SUBWAYS.

In use by the Metropolitan Telephone and Telegraph Company of New York; by the Bell Telephone Co. of Buffalo; by the Police and Fire Departments of New York and Chicago, etc.

THIS SYSTEM IS PARTICULARLY ADAPTED FOR ELECTRIC LIGHT, TRUNK & DISTRIBUTION.

ADDRESS THE COMPANY, TELEPHONE BUILDING, NEW YORK.

BAIN, 76 Market Street, CHICAGO, ILL.,

General Electrical Work, in all branches of Electrical Engineering. Consultation, etc. Correspondence confidential. TRY ME.

Charles R. Vincent & Co.

15 Cortlandt St., New York,

Ball High Speed Automatic Cut-Off Engines

Perfection of Regulation, Economical, Compact.

WAINWRIGHT COPPER CORRUGATED TUBE FEED WATER HEATERS,

Steam Boilers of Steel or Iron.

WRITE

For the Electrical Review's *New Catalogue* of all Electrical and Scientific Books.

18 PARK ROW, NEW YORK.

AMERICAN ELECTRICAL DIRECTORY FOR 1889

PRICE, $5.00.

The best and most permanent medium for advertisers in the electrical field.

The work reaches every electric light and power company in the country, besides telegraph and telephone companies.

This year's issue enlarged and improved.

Lists and reports of electric light and power companies, reports of National Electric Light Association, useful tables, etc., etc.

Send orders for copies of book, and for advertising space to *STAR IRON TOWER CO.*, Publishers of

American Electrical Directory, Fort Wayne, Ind.

Russell & Co.

MASSILLON, OHIO,

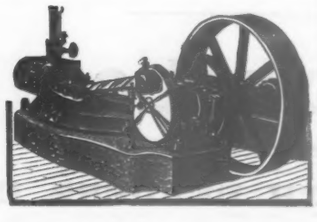
BUILDERS OF

AUTOMATIC ENGINES

BOILERS, ETC.

Complete Power Plants Furnished and Erected.

SEND FOR CATALOGUE.



BOOKS

ON ELECTRICAL SUBJECTS

Will be mailed to any address, postage prepaid, on receipt of price. Address,

ELECTRICAL REVIEW PUB. COMPANY,

13 Park Row, New York. P. O. Box, 3,329.

FISHER-RAE ELECTRIC RAILWAY SYSTEM,

FOR STREET AND SUBURBAN TRAFFIC.

Embraces new and valuable improvements which are requisite to economical operation and high efficiency.

THE ONLY SUCCESSFUL SYSTEM USING UNDERGROUND CONDUCTORS.

8 MILES OF CONDUIT IN ONE ROAD AT SAN JOSE, CAL.

OVERHEAD CONDUCTORS.

IMPROVED TROLLEY AND TROLLEY SUPPORT line of neatest design. Avoids "flashing" at wheel or line contact.

THE FISHER-RAE ELECTRIC RAILWAY SYSTEM

contains new features that will commend it to the careful attention of Street Railway Managers looking for reliable, easily operated and efficient electrical apparatus, designed to stand the test of work.

The FISHER-RAE SYSTEM

can be placed upon existing roads without alteration of track or road-bed, and upon cars in use without interruption to traffic of road.

POINTS OF SUPERIORITY.

A SINGLE MOTOR GEARED TO BOTH AXLES WITH IMPROVED NOISELESS GEAR.

FLEXIBILITY BETWEEN MOTOR AND CAR AXLES, INSURING CLOSE MESH AND PREVENTING BREAKING FROM SUDDEN STRAINS.

The use where desirable of a separate motor truck, making a six wheel car, securing greater comfort to passengers; motor trucks easily and quickly detachable, enabling change of motors from closed to open cars.

CORRESPONDENCE solicited, estimates furnished, and references given to important roads now in successful operation.

DETROIT ELECTRICAL WORKS,

7th and Woodbridge Streets, DETROIT, MICH.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

FOR ELECTRIC LIGHT, TELEGRAPH AND TELEPHONE LINES.

FACTORIES: WATERBURY, CONN.

J. L. BARCLAY, Selling Agent, THE ROOKERY, CHICAGO, ILL.

New York Office, 25 Park Place, THOS. L. SCOVILL, New York Agent.

PAILLARD NON-MAGNETIC WATCHES.

AVOID ALL IMITATIONS.

SEE THAT "Paillard's Patent" "Balance —AND— Spring" Is engraved on each movement

18 size full plate movement.

These Movements are of American Manufacture, and are the only American Movements made containing the Celebrated Paillard Inventions.

The Best American Non-Magnetic Watch.

ELECTRIC LIGHT PROPOSALS.

SEALED PROPOSALS WILL BE RECEIVED BY THE undersigned until 12 o'clock noon, Monday, April 1st, 1889, for lighting the City of Danville, Illinois, by electricity :

Said lighting shall be done with eighty (80) double carbon arc lamps of a nominal 2,000 candle power, twenty (20) of said lamps, to be mounted on five (5) towers, each 125 feet high, and the remaining sixty (60) to be suspended from poles not less than 25 feet high, by means of mast arms extending out from pole 22½ feet ; said towers and poles to be placed at such points in the city as may be designated by the City Council. Lamps to be lighted during the dark of the moon, and at such other times when the moon may be obscured, and when directed by the Mayor or City Marshal.

The contract to be let out for a period of five (5) years from the 1st day of June A. D. 1889.

The party receiving the contract will be required to enter into bond in sum of $5,000.00, with securities to be approved by the City Council for the faithful performance of same.

Also sealed proposals will be received at the same time, for furnishing said city with plant of sufficient capacity to do the above work, with sufficient reserve, said plant to be complete in every respect.

The city reserves the right to reject any or all bids.
Danville, Illinois, March 11, 1889.

E. WINTER, GOTTLEIB MAIER, J. S. ANKRUM, MICHAEL KELLY, JOHN C. STEUBE, *Committee.*

W. D. SARGENT, President.
E. H. CUTLER, Treasurer and Manager.

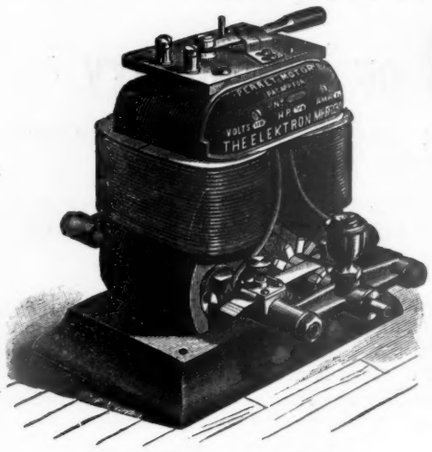
JNO. A. BARRETT, Vice-President and Consulting Electrician.
FRANK A. PERRET, Electrician.

The Elektron Manufacturing Co.

Cor. JAY and PLYMOUTH STREETS, BROOKLYN, N. Y. New York Office: 150 NASSAU STREET.

Manufacturers of

THE PERRET ELECTRIC MOTORS AND DYNAMOS.



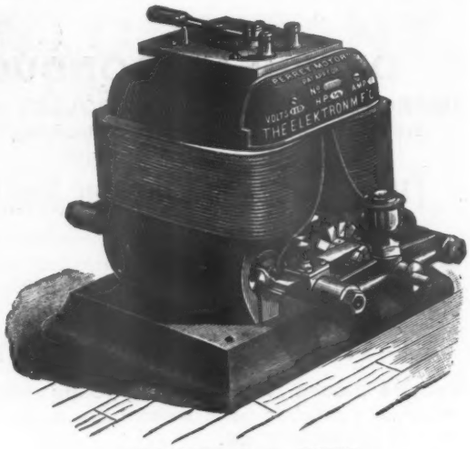
ONE-EIGHTH H. P. MOTOR.

SMALL SIZES A SPECIALTY

SIX SIZES NOW READY

1-8 to 1 1-2 H. P.

Laminated Field Magnets, Lowest Armature Resistance yet attained. No Lead to Brushes, consequently no Sparking under Changes of Load.



ONE-SIXTH H. P. MOTOR.

EFFICIENCY, REGULATION AND EXCELLENCE OF WORKMANSHIP

FAR IN ADVANCE OF ALL OTHERS OF EQUAL SIZE.

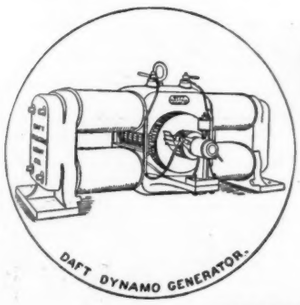
☞ Investigate Carefully and be Convinced. Catalogues Furnished on Application.

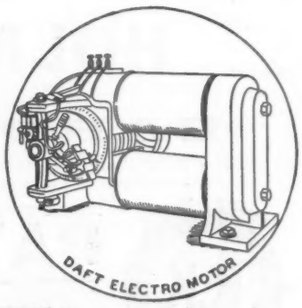
THE

Daft Electric Light Company,

General Offices, 115 Broadway, New York City.

FACTORY, MARION, N. J.





EQUIPS

STATIONARY ELECTRICAL POWER INSTALLATIONS,

With Dynamo-Generators from 1 to 250 H. P., and Electro-Motors, 1-2 to 100 H. P.

ALSO

Electric Street, OR Trunk, Railways

With Stationary Plant, Electro-Motive Machinery and Conductive Systems,

EITHER OVERHEAD, SURFACE OR UNDERGROUND.

Independent Railway-Motors from 10 to 150 H. P. and Motor-Cars from 5 to 50 H.P.

The Daft System rigidly proscribes the employment of currents of a

Potential Dangerous to Life.

For Particulars and Estimates address the New York Office.

M. T. Greene, President. Geo. A. McKinlock, Treasurer. Wm. H. McKinlock, Secretary.

Central Electric Company,

GENERAL WESTERN AGENTS OKONITE WIRE AND CABLES,

OKONITE TRADE MARK.

Candee Weatherproof Electric Light Line Wire

ABSOLUTELY THE BEST.

A COMPLETE STOCK OF GENERAL ELECTRIC SUPPLIES ALWAYS ON HAND. SHIPMENTS PROMPT.

CENTRAL ELECTRIC COMPANY, 42 LA SALLE STREET, CHICAGO, ILL.

All GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.

PHOSPHOR-BRONZE

INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

THE

American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

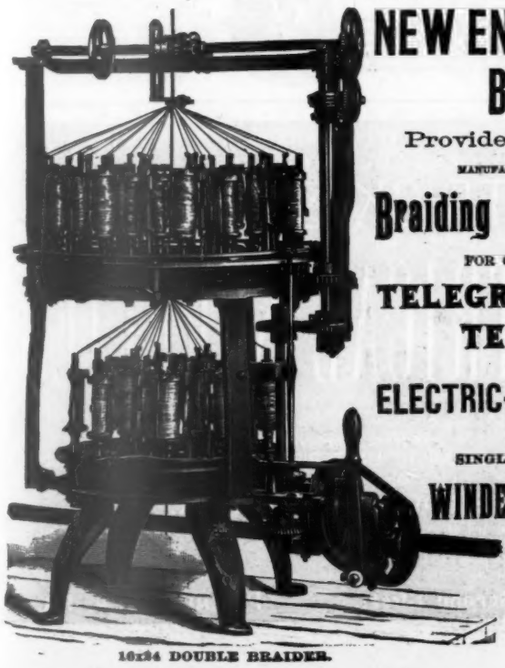
WILLIAMS & POTTER,

15 CORTLANDT ST., NEW YORK.

Engineers & Contractors,

GENERAL AGENTS,

STRAIGHT LINE ENGINES



16x24 DOUBLE BRAIDER.

NEW ENGLAND BUTT CO.,

Providence, R. I.,

MANUFACTURERS OF

Braiding Machinery

FOR COVERING

TELEGRAPH, TELEPHONE AND ELECTRIC-LIGHT WIRE

ALSO

SINGLE AND DOUBLE

WINDERS AND BRAIDERS

Of every Description for Silk, Worsted and Cotton Braid.

FINE CASTINGS A SPECIALTY

HEADQUARTERS IN NEW YORK CITY FOR

STANDARD MILLING MACHINES,

Universal or Plain

FOR LIGHT OR HEAVY WORK.

ALL SIZES READY FOR QUICK DELIVERY.

Machines shown in operation by the Manufacturers,

E. E. GARVIN & CO.

139-141-143 Centre Street,

NEW YORK CITY.

☞ Send for Illustrated Catalogue.

THE

India-Rubber and Gutta-Percha Insulating Co.

MANUFACTURERS OF

ALL KINDS OF INSULATED WIRES AND CABLES.

Guaranteed to give satisfactory services under ground and over head. Specially adapted for Chemical Works, Paper Mills, Dye Works, Coal Mines, etc., etc.

PRICES AND SAMPLES ON APPLICATION AT

No. 159 Front Street, New York City.

National Telephone Manufacturing Co.

620 ATLANTIC AVENUE, BOSTON, MASS.

SOLE MANUFACTURERS OF THE UNRIVALED

BENNETT TELEPHONES

FOR PRIVATE LINES AND SPEAKING TUBE USES.

Thousands of these instruments in use throughout the civilized world, and testimonials from every State and Territory of the Union attest to their merit and popularity.

LATE DECIDED IMPROVEMENTS IN EVERY FEATURE ADD GREATLY TO THEIR VALUE AND USEFULNESS, MAKING OUR IMPROVED APPARATUS

The Most Reliable and Practically Perfect Short Line Telephone in Use

OUR U. S. PATENTS—15 IN NUMBER—BROADLY COVER the use of a Hearing Tube, a Curved Transmitter Tube, perfect Insulating Devices, a Transmitting Wire, covered or muffled, or formed of two or more strands of wire twisted or braided together, and numerous minor features. The use of any of these devices with any other non-electric telephone infringes our rights, and renders the manufacturer, seller or user liable to suit therefor.

CIRCULARS AND PRICE-LISTS UPON APPLICATION. GOOD AGENTS WANTED.

WANTED.

YOUR NAME, BUSINESS AND ADDRESS. Send at once to me and be correctly reported in Whipple's

National Electrical Directory,

A postal card will do.

FRED H. WHIPPLE, DETROIT, MICH.

PHILIP K. STERN, Eastern Representative, 44 Broadway, New York.

TO CONTRACTORS FOR ELECTRIC LIGHTING.—The Hackensack Improvement Commission invites proposals for furnishing, operating and maintaining 200 Incandescent Electric Lights for lighting the streets and public places of Hackensack, N. J.

Bids must be in writing and presented to the President of the Commission, on or before Monday, April 1, 1889, at 8 P. M.

For specifications and further particulars, address,

DAVID TERHUNE,

President Hackensack Improvement Commission,

HACKENSACK, N. J.

BELL HANGERS' HAND BOOK

BY F. B. BADT.

106 Pages, 97 Illustrations, Flexible Cloth Binding, Type Pages 5½ x 3 inches.

PRICE ONE DOLLAR.

Just the Book for those engaged in Selling, Installing or Handling Electric Batteries, Electric Bells, Elevator, House or Hotel Annunciators, Burglar or Fire Alarm, Electric Gas Lighting Apparatus, Electric Heat Regulating Apparatus, Etc.. Etc.

THE ONLY BOOK OF THE KIND PUBLISHED.

FIRST EDITION TWENTY-FIVE HUNDRED COPIES. SENT, POSTAGE FREE, ON RECEIPT OF PRICE.

Western Electric Company, 227 South Clinton Street, Chicago.

AND 70 TRINITY PLACE, NEW YORK.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel. WASHINGTON, D. C.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.
Eastern Agents, C. R. Vincent & Co., Room 1
15 Cortlandt Street, New York.

THE STREET RAILWAY JOURNAL

Vol. V. 113 Liberty St., New York. Monthly, $3.00 Per Year.

ESTABLISHED 1884.
E. P. HARRIS,
Editor and Manager,
113 Liberty Street,
NEW YORK.

CONTENTS.
Each Issue has 120 Pages or more.
Valuable matter—90 pages per issue.
A Directory of Street Railways in the United States and Canada.
A Directory of Manufacturers of street railway appliances and materials.

Is the Best Advertising Medium through which to reach Street Railways.

Ball Electric Light Co.
18 CORTLANDT ST.
NEW YORK

MANUFACTURERS
The Celebrated BALL DYNAMOS and LAMPS
— FOR —
ARC AND INCANDESCENT LIGHTING.

This System is **mechanically** and **electrically** perfect and produces a steady, white and noiseless light with the minimum of expense, both as to the power required and the cost of repairs.

For descriptive Circulars or Testimonials, address

FACTORY:
9th Ave. & 27th St., New York City.
BALL ELECTRIC LIGHT CO.,
18 Cortlandt St., N. Y. City.

EDISON AUTOMATIC DYNAMOS
GIVE ABSOLUTELY PERFECT REGULATION.

Recent tests of four *Edison Automatic Dynamos* in multiple arc show constant pressure at the lamps with load varying from no load to full load, without any adjustment of brushes, regulators, or any parts whatever.

Specially adapted for lighting Theatres, Hotels, Asylums, Stores, etc.

Among the plants in which the *Edison Automatic Dynamos* have been installed may be mentioned the following:

Drexel Building, Philadelphia, 2,000 lights.
Barnes, Hengerer & Co., Buffalo, 1,600 lights.
Star Theatre, Buffalo, 800 lights.
National Theatre, Philadelphia, 1,000 lights.
United States Gunboat "Yorktown," Cruisers "Baltimore" and "Charleston," and Steamer "Pensacola," and a number of other plants.

Edison Automatic Dynamos are now being installed as follows:

New Depot of the Central Railroad of New Jersey, at Jersey City, 2,000 lights.
Steamer "Puritan," of the Fall River Line, 1,600 lights.

Send for Circulars on any class of isolated or Central Station Lighting. Estimates and Specifications Promptly Furnished.

THE EDISON UNITED MANUFACTURING COMPANY,
65 Fifth Avenue, New York.

THE TRENTON ENGINE.
AUTOMATIC CUT-OFF,
BALANCE VALVE,
POSITIVE EXHAUST.
ECONOMY, DURABILITY AND CLOSE REGULATION GUARANTEED.
PHŒNIX IRON CO., Trenton, N. J., B'ldrs
F. Van Winkle, 91 Liberty St. N.Y. Agent.

J. E. JEFFORDS & CO.,
Manufacturers to the Trade.
POROUS CELLS
Of Every Description, Made to Order.
25 years' experience in this branch of the business.
2716 to 2738 Salmon St., Philadelphia, Pa.

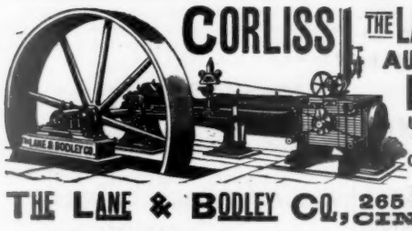
WM. H. COLE,
ELECTRICAL ENGINEER,
No. 775 TENTH AVE., NEW YORK CITY.

SPECIALTIES.—Electric Lighting, Electric Rail Roads, and power plants in connection with the same. Contractor for the construction of Electrical Machinery and Appliances. Independent, Reliable, Expert Measurements, Tests and Reports made.

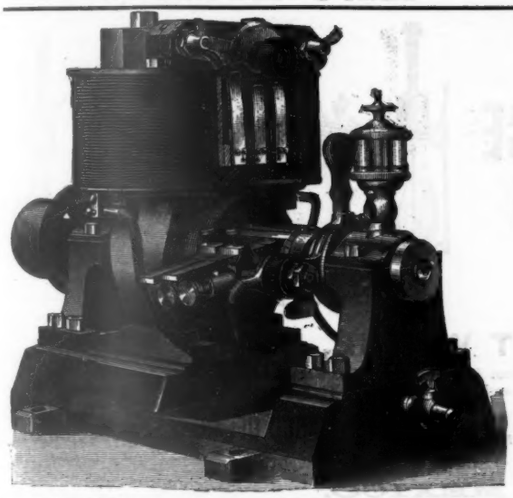
WELLINGTON
Belt Holder
The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to
W. R. SANTLEY & CO.
WELLINGTON, O.

THE ARMINGTON & SIMS
Automatic Cut-off Engine,
FOR ALL PURPOSES WHERE POWER IS REQUIRED.
CLOSE REGULATION,
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE,
OVER 2,500 ENGINES IN USE.
— SEND FOR CIRCULAR. —

FRANKLIN S. CARTER CHAS. M. WILKINS. E. WARD WILKINS.
ESTABLISHED 1867.
PARTRICK & CARTER,
MANUFACTURERS OF AND DEALERS IN EVERY DESCRIPTION OF
ELECTRICAL SUPPLIES.
SOLE PROPRIETORS OF THE
PATENT NEEDLE ANNUNCIATORS AND BURGLAR ALARMS.
WE MAKE A SPECIALTY OF
BELLS, DISQUE LECLANCHE BATTERIES, GAS-LIGHTING APPARATUS
AND A FULL LINE OF
SUPPLIES FOR ELECTRIC BELL WORK.
We publish Catalogues of all our Manufactures, and will forward to any address upon application.
N. B.—When applying for Catalogues, please state whether "Electric Bell" or "General Supply" Catalogue is wanted, and if in the trade enclose business card for discounts.
114 South Second Street. PHILADELPHIA, PA.



CORLISS THE LANE & BODLEY CO.
AUTOMATIC CUT OFF
ENGINES
Unrivalled for Strength, Durability and Close Regulation.
CONSTRUCTION OF COMPLETE PLANTS A SPECIALTY.
THE LANE & BODLEY CO., 265 to 271 WATER ST., CINCINNATI, O.



"C. & C." ELECTRIC MOTOR CO.

402 & 404 Greenwich St., New York.

EFFICIENT ELECTRIC MOTORS,

MANUFACTURED FOR ARC AND INCANDESCENT CIRCUITS.

AUTOMATICALLY REGULATED

NEW ENGLAND OFFICE, 32 OLIVER ST., BOSTON.
WESTERN OFFICE, 139 & 141 ADAMS ST., CHICAGO.
SOUTHERN OFFICE, 25 CARONDELET ST., NEW ORLEANS.
PHILADELPHIA OFFICE. 301 ARCH STREET.

Warerooms, 224-232 Canal St., 118-126 Walker St.,
NEW YORK.
Manufactory, Flushing & Carlton Avenues, Brooklyn.

OXLEY, GIDDINGS & ENOS,

DESIGNERS AND MAKERS OF

Electroliers and Combination Fixtures

UNSURPASSED FACILITIES
For producing fixtures of the most approved designs for any system of
INCANDESCENT LIGHTING.
Special designs furnished upon application. Suggestions from architects and decorators faithfully executed.

STORED ENERGY.

ELECTRICAL ACCUMULATORS

Central Station Lighting
Isolated Lighting,

Railroad Car Lighting,
Long Distance Lighting.

ESPECIALLY ADAPTED TO

STREET CAR PROPULSION

AND

For operating Central Station and Isolated Plants during periods of LIGHT LOAD, enabling steam plant to shut down.

Can be used with any Direct System for completely displacing gas.

The ONLY Company owning and supplying complete automatic Regulating Apparatus for use with Accumulators.

WRITE TO

The Electrical Accumulator Co.,

44 Broadway, New York,

CHICAGO OFFICE, Phenix Building,
DETROIT OFFICE, 91 Griswold Street,

Stating system used, capacity of plant, power available and other requirements.

New Haven Clock Company,

29 MURRAY ST., NEW YORK, N. Y.

HEADQUARTERS FOR

GENUINE

LE CLANCHÉ BATTERIES

ALSO MANUFACTURERS AND DEALERS IN

—ALL STYLES OF—

ELECTRICAL APPARATUS.

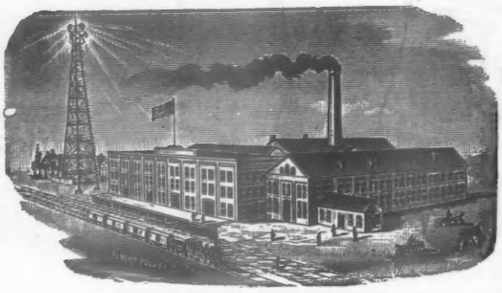
SEND FOR OUR ELECTRICAL CATALOGUE, ILLUSTRATED IN COLORS.

BOOKS ON ELECTRICAL SUBJECTS
Will be mailed to any address, postage prepaid, on receipt of price. Address,
ELECTRICAL REVIEW PUB. COMPANY.
13 Park Row, New York. P. O. Box, 3,329.

Fort Wayne Jenney Electric Light Company,

FORT WAYNE, IND.

The most carefully worked out and Complete Alternating System of Electric Lighting in existence. Armatures and Converters guaranteed. 12-16 candle-power Lamps to the mechanical horse power guaranteed.



MANUFACTURERS OF THE

SLATTERY INDUCTION SYSTEM

OF

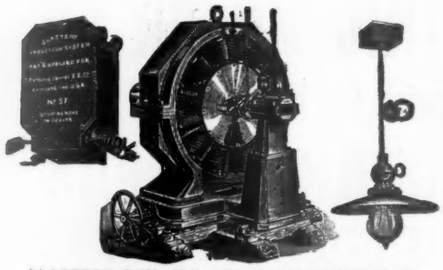
Incandescent Lighting

AND THE

Original Jenney System

OF

ARC LIGHTING.



SLATTERY DYNAMO, LAMP AND CONVERTER.

CORRESPONDENCE SOLICITED.

JENNEY DYNAMO AND LAMPS.

MAIN OFFICE AND WORKS, FORT WAYNE, IND.

New York Office, Room 45, 115 Broadway.

Manhattan Electric Light Co., 511 Broadway, Sole Licensees and Agents for New York City and Brooklyn.

CHICAGO OFFICE, 185 Dearborn St., *W. J. BUCKLEY, Manager.*

PHILADELPHIA OFFICE, 907 Filbert St., *G. A. WILBUR, Manager.*

SAN FRANCISCO OFFICE, 217 Sansome St.

F. ADAM SUC'S, CITY OF MEXICO.

BENTLEY-KNIGHT ELECTRIC RAILWAY CO.,

25 & 27 TENTH AVE., NEW YORK.

Contractors for the Construction of City Street Railways and Surburban Tramways using either Underground, Surface or Elevated Conductors.

ESTIMATES FURNISHED ON APPLICATION.

N. B.—The Bentley-Knight Electric Railway Company absolutely controls all efficient and economic methods of operating electrically-equipped cars by means of conductors contained in and protected by sub-surface conduits. Entering the field long in advance of all others, it first encountered the many difficulties which had to be met and overcome; and the many patents now owned and controlled by it effectually cover each and every detail (both mechanical and electrical) necessary to the successful construction and operation of an electrical railway in a city street.

Sprague Electric Railway and Motor Company.

THE NEW SPRAGUE ELECTRIC MOTOR TRUCK.

DETAILS OF TRUCK:

Flexible Suspension, Noiseless Gearing, All Bearings Self-Oiling and Dust-Proof, Brushes of a New Design, and Perfection as regards Ease of Running. All Parts Completely Incased and Protected from Dust. All Bearings independently Removable. Every Part Designed to be readily Accessible, and to Reduce all Necessary Attendance and Care to a Minimum.

FOR CIRCULARS AND FULL INFORMATION, ADDRESS

Sprague Electric Railway and Motor Co., 16 & 18 Broad Street, N. Y.